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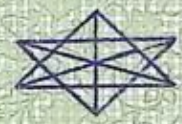

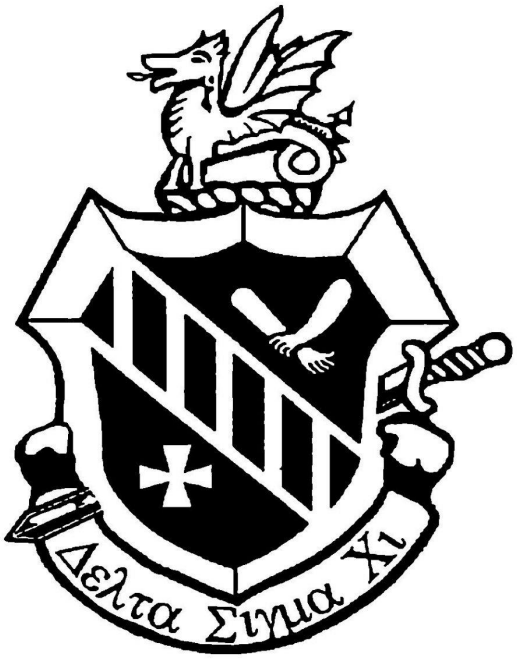

CORRELATIVE CHIROPRACTIC HYGIENE

by

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Published by
THE PALMER SCHOOL OF CHIROPRACTIC
(CHIROPRACTIC FOUNTAINHEAD)
Davenport, Iowa

Printed in the United States of America

To the Memory of
Alfred B. Hender, M.D., D.C., Ph.C.
1874—1943
My friend and teacher
This Volume is Affectionately Dedicated

PREFACE

The title of this monograph, Correlative Chiropractic Hygiene, was chosen because it was written for students and practitioners of Chiropractic, and throughout its entirety, an attempt has been made, insofar as possible, to conform to the Chiropractic concept of Hygiene.

It is unfortunate that the term Hygiene still persists as a distinct subject matter predicated upon the preservation and maintenance of health, because in actuality its demise was written some years ago when it was encroached upon by various and sundry contingent subjects. The study as we know it today is a composite of Bacteriology, Immunology, Parasitology, Sanitation, Engineering, Obstetrics, Geriatrics, and Epidemiology, to mention the more outstanding ones.

In these pages I have endeavored to meet a very real problem in a realistic manner. This proposition is based upon the fact that most examining boards, chiropractic and basic science included, expect the student to present his answers as they have been discussed here. It goes for naught to say that this state of affairs is not in strict accord with the true meanings we attach to certain phases of Chiropractic Hygiene. Nevertheless, I feel that the chiropractic student can dovetail his concepts of the etiological factors of disease with those advanced here if he will but utilize the tenets of Chiropractic as he has been taught. Failure to do this may give basis for unjustifiable condemnation that the volume is far removed from chiropractic. Such is not the case. I have endeavored to present the subject as seen through the eyes of nearly nine years of teaching Hygiene and Sanitation in such a way as to best fit the student to converse intelligently upon the subject, as well as to prepare him for certain other requisites pertinent to his profession. In support of this stand, I quote a well known couplet from Alexander Pope's "Essay on Man":

"All seems infected that th' infected spy,
As all looks yellow to the jaundiced eye."

Because of the contemporary magnitude of Hygiene, this book has been designed to present those restricted phases of the sub-

ject most commonly encountered, and to present them as fully and simply as possible. An attempt has been made to break away from masses of technical detail needed only by the specialist in this field.

In view of the fact that the student needs to acquire an adequate vocabulary of the technical terms used in hygiene, definitions are given quite freely and a glossary has been added to augment this working knowledge.

Every textbook is, to some extent, a compilation, and it is well to acknowledge this at the onset. I trust, however, that this volume will not be found wanting in the expression of individual opinion, particularly as regards the inclusion of certain sections dealing with Immunity, Hydrotherapy, and Diathermy.

In conclusion, I would advance the wish that this book will become a valued part of our evergrowing library dealing with the Art, Science, and Philosophy of Things Natural.

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CHAPTER I

Personal Hygiene

Personal hygiene is that branch of hygiene which deals with man individually, rather than collectively. It takes into consideration such features as personal cleanliness; bathing; hygiene of the internal organs; environmental cleanliness in the home; and proper foods. In other words, it is the study of health rules as applied to the individual for the preservation of a state of health. Most important, of course, from a chiropractic standpoint, would be the regular periodic check-up to forestall any disease processes which might arise from an undiscovered vertebral subluxation. In the strict sense, this would constitute prophylaxis (chiropractic) to prevent any diseased state from existing.

DENTAL HYGIENE

This form of personal hygiene deals with the care of the teeth and adjacent structures. Its purpose is to preserve the teeth because of their vital importance in the maintenance of adequate nutrition by proper mastication.

The teeth should be well brushed and the mouth rinsed at least twice every day. The use of dental floss to reach tooth surfaces untouched by the tooth brush is beneficial. A visit to the dentist every six months is considerd good hygiene as certain deposits may build up on the teeth which can be removed only by professional methods.

The health of the teeth may also be affected by including proper foods in the daily meals.

Oftentimes the question arises as to which is the best dentifrice, tooth paste or tooth powder. Actually there is no difference between them because both are designed to help the brush in cleaning the teeth and they are usually the same chemically. A

tooth paste is merely a tooth powder which has been mixed with glycerine or some similar vehicle.

The oral cavity has been found to contain more than 100 different types of micro-organisms which in the presence of food particles and a warm, moist environment are able to develop optimally. The great majority of these are non-pathogenic but some of them are capable of setting up chemical reactions destructive to tooth enamel and other parts. Failure to practice proper dental hygiene may make an individual susceptible to decay of the teeth, or infection of the gums. Two of the more common diseases of the oral cavity which may follow improper care of the teeth and surrounding structures are Pyorrhea and Vincent's Angina.

Pyorrhea alveolaris is commonly called pyorrhea or dental abscess and is an inflammation of the periosteum of the tooth socket with shrinking of the gums, loosening of the teeth, and various constitutional disturbances. It seems to start as a gingivitis, and may progress to a point where severe symptoms of anemia, lassitude, and loss of weight may occur. At the onset the pus collects along the gum line but may eventually form abscesses deep beneath the teeth in the dental periosteum.

Vincent's Angina is improperly called trench-mouth. When the inflammation affects the throat and tonsils, it is called Vincent's angina; when it attacks the gums and oral cavity, it is called trench-mouth. It is characterized by the formation of a pseudomembrane beneath which ulceration occurs and may thus be confused with the lesion of diphtheria. It is considered highly contagious, its usual means of transmission being through kissing, or the use of contaminated objects such as eating utensils, water glasses, and the like.

HYGIENE OF THE EYES

The eyes are one of man's most priceless possessions in that they enable him to perceive the world about him. They should

be afforded the best of care to maintain them in a healthy state and preserve them as long as life exists.

Trauma to the eyeball may produce serious results if pierced by some sharp object such as a bit of steel, or glass, or dust. For this reason industrial hygienists recommend that protective glasses be worn in such occupations as may produce eye injuries.

Eye-strain may not only cause ocular symptoms but may produce constitutional signs as well; such as headache, nervousness, vertigo, and gastric upsets. Much of this eye-strain is due to improper illumination and the student is referred to the chapter on the hygiene of lighting for a more detailed explanation of the effects of inadequate lighting upon the eye. In reading or other work requiring close attention to detail, the light should be of the proper intensity and should come over the shoulder. Reading matter should be held approximately fourteen inches from the eye. An individual should not read in the reclining position. It places strain upon the muscles of the cervical region, results in vascular congestion in the eyeball, and makes heavy demands upon the muscles of downward rotation of the eye.

Color-blindess is an abnormal state in which the eye is unable to recognize one or more of the primary colors, red, green, etc. It is said to be hereditary, but has been known to follow injury or disease of the eye. In some cases color perception has been materially improved by the addition of large amounts of vitamin A to the diet.

Near-sightedness, also called myopia, may be greatly influenced by proper hygiene of the eye. Near-sightedness does not decrease with old age, contrary to a popular misbelief based upon the observation that certain elderly people may have been myopic but in advancing years read better without glasses. This is due to the fact that the aging eye and its failing vision may reach a temporary balance with the myopia. Conditions which may increase near-sightedness are: illumination of improper quantity or quality for close work or reading; holding books or objects too near the eyes; faulty posture of the head or body while reading,

with ocular congestion from muscle pressure on the eye-ball; or from any impairment of the general health which may weaken the eye and reduce vitality in the sclerotic coat. In progressive myopia where near-sightedness is growing progressively worse the case should be advised to abstain from work requiring much reading or close attention to detail for a period of six months or a year. If, at the end of this period, the eye shows no increase in myopia, the work may be resumed cautiously with frequent examinations to check the condition. If it starts once again to worsen another rest period is advocated. Of course, many cases of myopia are definitely the result of subluxations of the spinal column as attested to by clinical results with this disorder.

Eye-exercises to correct various muscular weaknesses are now common practice, particularly among optometrists. It is said that excellent results have been obtained where weakness or paralysis of the orbital muscles have brought about inability to properly converge, rotate, or otherwise synchronize the eyes. However, in cases of refractive errors, the usual procedure is to recommend glasses, so that there will not be excessive exercise and fatigue upon the muscle of accommodation. (An oculist or ophthalmologist is a doctor of medicine who has had special training in the eye and its diseases. An optometrist is a practitioner who specializes in measuring the visual powers and prescribes eyeglasses to correct visual defects. He is not usually a medical graduate.)

HYGIENE OF THE EARS

The ears are delicate organs which comprise the apparatus of hearing and of equilbrium. A diseased ear may have far reaching repercussions in other parts of the body and in itself. It is particularly susceptible to poor hygiene and other damaging influences. Among the more common ear symptoms are:

Deafness—which may be due to paralysis of the acoustic nerve, the recent use of quinine or similar drugs, or to the accumulation of ear wax.

Ringing—also called tinnitus—noted in nervous debility, Meniere's disease, anemia, hypertension, and after the use of quinine and salicylic acid.

Acuteness—a person may experience unusual acuteness of the auditory sense just prior to an attack of delirium.

The hygiene of the ears consists of the prevention of accumulated foreign matter, gentleness in cleaning, and avoiding exposure to undue cold air or water.

If ear-wax or cerumen accumulates in the ear to the extent that it interferes with hearing, or produces vertigo, the ear may be syringed with warm water (110 degrees Fahrenheit).

Ear-aches sometimes arise from exposure to cold water or air and the prevention of undue exposure is the best hygiene.

Scratching the ear with unclean fingers or an object such as a match may convey and spread certain fungus infections.

Hearing aids are mechanical devices designed to act as conductors of sound waves around a part of the ear inactive due to trauma, disease, or other causes. Most of them transmit sound through bone tissues or the skull into the functioning acoustic nerve. They have enjoyed wide-spread popularity and justly so, because there are few physical handicaps which may have such far-reaching psychological effects as difficulty of hearing.

POSTURE

Posture or body-mechanics is the mechanical correlation of the various systems of the body, particularly in reference to the skeletal, nervous, visceral, and vascular systems. A good posture is one in which there is the least possible strain upon any particular part or system of the human body; and, as a result, there is the utmost in physical efficiency. A poor posture may crowd the walls of the abdominal and thoracic cavities and their contained viscera thus inferering with their proper functions and blood supply.

In a normally developed adult, the weight bearing line passes

through the lobe of the ear, the shoulder, trochanter, knee and ankle when the person is viewed from the side. Seen from the posterior, there should be no spinal scoliosis and no faulty alignment of the knees, legs, and ankles. Wide-spread, sagging scapulae are indicative of flattening of the chest and abdominal distension. In children under five years there may be some lordosis and abdominal protuberance, but this should be outgrown normally by the eighth or ninth year.

Good posture is a matter of good health and proper training. If the individual stands, sits, and walks erectly with the thought in mind of developing a proper posture, he will soon find the muscles and ligaments and other concerned structures will respond readily. A person with good body mechanics but lacking comely attributes is oftentimes more attractive than the physiognomically pleasing individual who is a devotee of the "debutante slouch."

Poor posture, or, in a sense, poor muscle-hygiene, may contribute to disorders of the thoracic, abdominal and pelvic viscera due to prolonged pressure or malposition. Also many spinal curvatures are the result of poor posture habits. The best time to develop proper posture is in childhood and this may be accomplished along two distinct lines:

1. Training the child to assume voluntarily the correct posture by explanation and demonstration.

2. Strengthening by exercise weak muscles which allow the child to lapse into poor posture. The exercise should be used with discretion and not carried out to a point of fatigue as this will tend to aggravate rather than correct the condition. Since the principle of body-mechanics from the standpoint of the muscular system is merely proper tonicity and antagonistic tension, then it follows that restoration of normal muscle tone or tension will help correct such a deficiency.

It must be borne in mind the vital part a subluxation of the spinal column may play in such a muscular imbalance and post-

ural hygiene would not be complete unless the possibility of such a factor had been ruled out as a contributing factor.

Among the more common postural defects in school-children which are carried over into adulthood are: round shoulders, a drooping head position, protrusion of the abdomen with exaggerated lumbar lordosis, and a tilted pelvis, the so-called "Dressmaker's hip." All of these conditions may be markedly improved by intelligent and persevering instruction in the use of exercises and games designed to strengthen and rebalance weak muscles. The part a normal alignment of the spinal column would play in such correction should be obvious to the chiropractic student and no further discussion is needed here.

WEIGHT AND HEALTH

The relationship between weight, health, and longevity is very close. There is a definite normal weight for a specified height and in the best interest of health, this ratio should be maintained insofar as possible. Any decrease in weight and particularly an increase in weight, may be detrimental to health and decrease the life-span of an individual. Of course, consideration must be given to the bony framework of the individual as he may weigh a lot more than his height would indicate and still not have an unhealthy fat (obesity). Obesity is an abnormal amount of fat on the body and may be due to hereditary tendencies, overeating without sufficient exercise, glandular deficiencies, hypothyroidism, and a low basal metabolism. Obesity is of special interest to insurance companies because of its effect upon health and length of life. They place obese types in three groups: 1. Those with heavy bone framework; 2. those with medium framework; 3. those with delicate framework. The last 2 types are sometimes helped by organ-therapy and for the first type, diet and exercise are recommended.

The following table gives the ideal ratio for weight and height

in an average individual with the bony and muscular framework of a young male adult.

Height (inches)	Weight (pounds)	Height (inches)	Weight (pounds)
60	120	70	156
61	122	71	161
62	125	72	168
63	128	73	175
64	131	74	182
65	135	75	189
66	139	76	197
67	143	77	205
68	147	78	213
69	151		

HYGIENE OF THE SKIN

Good hygiene of the skin is necessary for the normal functioning of its excretory and heat regulating mechanisms. Personal cleanliness is chiefly a matter of habit and is one of the most desirable of practices from many different standpoints.

Bathing is of benefit to the human body, not only in its promotion of cleanliness, but also for its physical stimulation. Failure to observe proper bathing procedures can result in obnoxious body odors, tendency towards certain skin diseases and infestation with parasites, such as lice, etc. In the interest of good hygiene, it is desirable that at least two baths be taken each week, although in a warm climate, a daily bath would not be too often. A shower bath is more sanitary than a tub bath, and the water should be tepid rather than cold, although a daily cold bath is a fine tonic provided the individual builds up this practice gradually and maintains it each day.

A cold bath (below 65 degrees Fahrenheit) acts as a stimulant and should be taken before breakfast. The first reaction is con-

traction of the peripheral blood-vessels and the respirations are increased in frequency as well as depth. The nervous system is stimulated.

A warm bath (from 95-98 degrees Fahrenheit) has the opposite effect to a cold bath. The peripheral circulation is increased as is pulse and respiration; perspiration is started and the body temperature is raised. This type of bath has a soothing, sedative effect and may be used to counteract insomnia by inducing sleep. It may be of value in removing muscular soreness such as occurs after severe exercise.

A bath should not be taken after a heavy meal because dilation of the blood vessels of the skin draws a large amount of blood away from organs of digestion. The glands and organs of digestion are dependent upon blood for raw material to manufacture secretions. Digestive fluids insufficient to properly care for ingested food would produce digestive stasis with consequent inertia and putrefaction of the food in the alimentary tract.

A hot bath (100 to 110 degrees Fahrenheit) must never be taken by a person suffering from high blood pressure. It also has a pronouced depressing effect upon the body.

Hydrotherapy is the treatment of disease by the scientific application of water in any of its three forms: solid, as ice; liquid, as water; or gaseous, as steam. It may be used as packs, compresses, baths, douches, or in other ways. Hydrotherapy may be prescribed in conditions of insomnia, muscular tension, neurasthenia, circulatory disturbances, inflammations, retention of toxins, and metabolic disturbances. There have been many well-known ardent disciples of hydrotherapy, including James Jackson, Dr. J. Kellogg of the Battle Creek Sanitarium in Michigan, and Drs. Lindlahr and Tilden. The origin of hydrotherapy is said to date back to the time of Hippocrates, the father of medicine, who advocated the treatment of disease according to natural means such as water, air, and diet.

CHAPTER II

Stimulants

ALCOHOL

Externally, alcohol is a rubefacient and astringent. Used internally, it is a powerful narcotic and in this form is used therapeutically as ethyl alcohol, derived from the fermentation of starches and sugars. In the United States, grains and fruits are the chief sources from which alcohol is made. Its food value has been proven as being virtually nil and even its therapeutic value has been the basis of much controversy in recent years.

Alcoholism: results from excessive indulgence in ethyl alcohol, or from an uncontrolled desire for the alcoholic beverage. It may be the result of certain personality defects in which the person uses it to escape from reality; to some extent inhibiting ego-ideals and revealing the anti-social traits of the individual. Alcoholism may be divided into two stages, acute and chronic.

Acute Alcoholism: results from excessive indulgence in alcohol over a short period of time and is first characterized by a period of excitement and exhilaration which is later replaced by a state of depression. In the first period, the individual is mentally alert, physically active, his metabolic activities much elevated. This is soon followed by incoherent speech, dilated pupils, subnormal temperature, muscular incoordination, mental incoherency, and perhaps coma and possibly death. The care of such a case includes the emptying of the stomach, active flaggellation to keep the patient awake, and the administering of such stimulants as hot coffee, hot tea, or even hot water.

Chronic Alcoholism: results from the continued, regular use of alcohol in excessive amounts. It is characterized by a gradual physical and mental deterioration with loss of moral values and possible insanity. About 12% of all new admissions to state

hospitals are alcoholic psychoses. In a chronic alcoholic, it is common to find mental impairment, fine muscular tremors, injection of the conjunctiva, and redness of the nose. It predisposes toward chronic interstitial nephritis, biliary cirrhosis, and atheroma of the arteries.

Some of the more serious mental states produced in chronic alcoholism include dementia, Korsakoff's psychosis, chronic hallucinosis, and delirium tremens. The general care of such patients includes the withdrawal of alcohol and the substitution of a nutritious diet and proper hygiene.

In the case of delirium tremens, or D. T.'s as it is commonly known, the patient may suffer from visual and auditory hallucinations in which he sees demons, rats, or snakes peering at him from behind doors and walls. This serious mental imbalance must be treated by judiciously withholding alcohol, unless the pulse is very weak, and may require physical restraints and sedatives until the attacks have subsided.

The excessive use of alcohol has certain far-reaching effects upon society which may be grouped under the two main headings, economic, and hygenic. With the former we are not concerned here, aside from mention of the use of labor, transportation, storage, and factories which are required for its manufacture. As to hygiene and its relationship to alcoholism, the major detrimental effect seems to be the perpetuation of commercial prostitution. However, it would seem that the as yet comparatively unexplored field of psychiatry might well be considered, before placing the greatest onus upon alcohol as a contributing factor to prostitution. The mental deterioration of alcoholics with subsequent admission to state hospitals has already been discussed.

There is no doubt that the resistant powers of an alcoholic towards certain diseases is materially lessened and pneumonia is given as the classic example of such a lowered immunity. This tendency has been explained physiologically as a devitalization of

leucocytes with lessened phagocytosis. Undoubtedly, the toxic effects exert a deranging influence upon the nervous system and the natural defenses of the body are reduced.

COFFEE

The stimulating effects of coffee are due chiefly to the alkaloids, caffeine and theine, which it contains. These act upon the nervous system and the kidneys. It has no nutritive value, but is known to be the most powerful stimulant which can be safely taken into the system.

Coffee may have both good and bad effects, depending upon the manner of its use. Acting upon the nervous, muscular, and vascular systems, it relieves fatigue, and strengthens the heartbeat. It may be advised in conditions of low blood pressure, and has a diuretic action upon the kidneys. It is a valuable aid in overcoming symptoms arising from poisoning by alcohol or other narcotics.

Caffeinism arises from an overdose, or excessive use, of coffee and is characterized by palpitation of the heart, flushing of the face, nervousness, insomnia, and mental depression. Coffee should not be used by people suffering from ocular congestions, heart disease, hypertension, neurasthenia, and dyspepsia.

TEA

The principal chemical in tea is tannin. This is a vegetable astringent of no appreciable food value, but is mildly stimulating to the nervous system and acts slightly upon the heart.

Tea used to excess or brewed in very strong solutions may interfere with gastric digestion or intestinal peristalsis, thus producing constipation.

COCOA AND CHOCOLATE

Both cocoa and chocolate are preparations made from the seeds of the cacao tree of South America. These seeds do not con-

tain any carbohydrate, but all other nutritional elements are present in them with fat being predominant. Protein of the bean is only slightly soluble, so is not readily available for assimilation. In the production of chocolate, more fat is allowed to remain than in making cocoa, so it has more nutritive value than the latter and is a concentrated food of high nutritional value.

The mild stimulation brought about by the use of cocoa and chocolate is due to the alkaloid, theobromine, which has the advantage of stimulating, without producing insomnia or other ill effects.

TOBACCO

Tobacco owes its stimulating effect to nicotine, which is liberated upon the combustion or solution of tobacco. Nicotine is a poisonous alkaloid found in all parts of the tobacco plant, but more especially in the leaves. Aside from its far reaching effects upon the economic system of society, tobacco presents a hygienic question of profound proportions due to the extremely widespread use it enjoys in the United States and the rest of the world. Much discussion, both pro and con, has been aimed at the effects of tobacco upon the human body. Medical books of the early century gave much space to elaborate illustrations showing pulmonary systems in various stages of ulceration and necrosis with tobacco facies much in evidence. Today, a more sane and scientific approach prevails. Most modern authorities are agreed that the prime effect of tobacco upon health is due to a habit formation which may undermine morals from lack of self-discipline or will-power.

Its physiological action is essentially that of a strong stimulant particularly upon intestinal activity; it acts also upon other structures of the body, such as the heart and kidneys. Tobacco can be classified also as a poison which acts mainly upon the Vagus nerve and its innervated organs.

There is evidence also that inhalation of tobacco smoke may be indirectly or directly responsible for certain cases of vaso-

spastic states. If inhaled to excess, it may produce symptoms of tobacco heart, or an anginal type of pain.

Also named as evil consequences resulting from the excessive use of tobacco are digestive disturbances, anorexia, gastritis, insomnia, nervous tremors, muscular tics, toxic eye-disorders, impairment of the mental powers for concentration, and catarrhal inflammation of the upper respiratory tract.

CHAPTER III

Sexual Hygiene

Sexual hygiene is the preservation of a state of health of the sexual apparatus with special reference to the part played by the moral aspect of sexual practices.

The primary aspect of unhygienic sexual practice is that of masturbation. It has long been realized by psychologists and writers in the field of sex behavior that masturbation is common to a large proportion of mankind at some period in their lives but is not necessarily harmful or significant unless continued to excess or employed when some more natural form of sexual outlet is available.

When the individual becomes aware of the possible deleterious consequences of self-pollution, the practice is generally stopped, particularly when a happy marriage has intervened. However, if long continued, it tends to raise doubts and fears in the individual's mind and may produce a definite psychosis with its train of associated complexes and symptoms.

Masturbation is more commonly indulged in than sexual intercourse due to the fact that it is dependent upon the desire of one individual rather than two, therefore more easily obtained. It was previously believed that self-abuse had rather terrifying effects upon the mental and physical well-being of the individual, but this has since been proved fallacious except in a small percentage of cases indulging in the habit to gross excess. Nevertheless, it is very important that the individual be aware of its possible consequences psychologically, so that good sexual hygiene might be properly evaluated.

Practical methods of preventing masturbation in children includes orders that under no circumstances should the nurse or mother ever be permitted unnecessarily to handle or expose the

genital organs of children. Caution must be used that smegma will not collect behind the glans under the foreskin of the penis or between the labia where it may set up irritations.

Children should be permitted to have separate beds and as much privacy as possible. The regular use of the sponge bath may contribute much to the prevention of self abuse.

Tight clothing which may pinch the genital region should be avoided. Finally, the food of children should be restricted as regards overindulgence in meat, highly-seasoned dishes, coffee and other stimulants which may arouse animal propensities.

Good sexual hygiene is based upon the premise that the individual has sufficient will-power to abstain from malpractices and this in turn is interdependent upon the right mental approach. Suppression of masturbation may be helped by active mental and physical exercise, cleanliness, sanitary environment, and avoidance of circumstances which would stimulate the sexual appetite. The best single preventive of masturbation is intelligent and early instruction by the parents who are aware of the sex tendencies of their children and who are able to instruct their offspring in such matters; delicately, yet with clarity, so that the child or adolescent will be able to understand much more clearly the proper hygiene of the sexual structures. It is far better that the child learn the truth from his parents than to pick up half-truths and misconceptions from the gutter and other dubious sources. Proper sexual hygiene and a happy marriage are inexorably bound up together.

CHAPTER IV

Social Hygiene

Social hygiene is the term applied to the hygiene of venereal disease, and includes the prevention of gonorrhea, syphilis, chancroids, and lymphogranuloma inguinale. In its broad sense, it includes public as well as individual control of the disease. Only in recent years has the public awakened to the fact that, like the poor, venereal disease is always with us; and has taken it from a status of secrecy, to be discussed only in hushed tones, out into the searching gaze of publicity, where it belongs as an enemy of society. Perhaps the best description of a venereal disease was one displayed prominently in the window of a local drugstore advertising a clinic for 'congenial syphilis'—the inadvertent omission of the "T" hitting very close to the cause of the spread of venereal disease.

Sexual indulgence by young unmarried men and women is directly responsible for an immense amount of disease and suffering, both physical and mental. Not only are the offenders themselves involved, but in later years they may transmit the disease to their partners and so double the infection. Once a person has been infected with venereal disease, it is extremely doubtful that a complete, unequivocable cure can be effected—even with gonorrhea—and perhaps years after the disappearance of the symptoms the condition may break out once again after an alcoholic or sexual excess.

Prostitution is held up as being the main channel through which the spread of venereal disease is affected, but more recent and complete studies have shown that juvenile delinquency and a lowering of morality have been omnipotent factors as well. If the young man or woman about to indulge in illicit sexual intercourse was cognizant of the fact that some authorities place the

number of young men infected with gonorrhea as high as fifty per cent, and the number of young women at hundreds of thousands, it would certainly act as a deterrant. Three out of ten young men engaging in illicit sexual intercourse without observance of proper prophylaxis will contract a venereal disease, according to reliable statistics. Gonorrheal inflammations, incidentally, are a frequent cause of involuntary sterility in both the male and female. Some believe that gonorrhea accounts for at least fifty percent of these cases.

Abstinence from sexual intercourse extramaritally is the only sure means of preserving sexual purity and hygiene. However, from a standpoint of large scale practicability, sexual information may do much for public intelligence concerning this group of diseases. A well planned hygienic approach to the matter should include the following:

1. Point out the true sources of the disease. The concept that venereal disease may be contracted from toilet seats and like fomites is rather far-fetched, although not improbable. Most venereal infections are the result of contact with infected sources; most commonly prostitutes, or delinquents.

2. Control of prostitution. This control is accomplished by two methods—regulation and suppression. Regulation by local authorities is not practiced to any extent anywhere in the United States at this time. It was found to be an entirely unsatisfactory method of prevention of venereal disease. Instead, prostitution is controlled to some extent by suppression, which is within the legal jurisdiction of local police. Its object should be to decrease the number of houses of ill-fame and make the practice of prostitution more difficult.

3. Education. Measures should be employed publicly to acquaint the individual with facts regarding the spread of venereal diseases, their effects upon the human body and methods of prevention.

4. Prophylaxis or the prevention of venereal disease, by chemical or other means should be discussed, since some individuals

will expose themselves to infection regardless of the consequences, and an intelligently carried out system of prophylaxis is an efficient control in many cases.

The part which Chiropractic might play in the control of venereal disease is the same as that which it plays in any so-called contagious disease—namely, that a healthy body with normal function in all its tissue cells can withstand the attacks of social diseases. Most cases contract social disease when the resistance of the body is at a low or abnormal level—during alcoholic indulgence, fatigue, or similar circumstances. The tissue cells then are depleted physiologically and may be unable to effectively resist the forces attacking them. Accordingly, one hundred percent of nerve force to all parts of the body and the observance of ordinary rules for good health are the most important preventive factors aside from avoidance of exposure.

CHAPTER V

Feminine Hygiene

Feminine hygiene ordinarily means the science of preserving a woman's health; but, because of the euphemistic way in which marriage hygiene and feminine hygiene have been used by advertisers, the term is no longer applicable in its strict sense. Instead of meaning care of the vaginal tract, or intimate cleanliness, it has been twisted to convey the impression that feminine hygiene is the method of controlling birth, by chemical or mechanical means. Cleanliness of the vaginal tract during menstruation, in the intermenstruum and after the marriage act have become decidedly of second rate importance. Indeed, proper bathing and an occasional cleansing douche are rarely mentioned today in the subject of feminine hygiene. Instead, there are ponderous tomes dealing with the subtleties of feminine or marriage hygiene from the standpoint of spermicidal chemicals and mechanical barriers against the invasion by foreign bodies (spermatozoa) of the uterine cavity. Five different types of "feminine hygiene" products are extensively advertised: (1) menstrual period regulators; (2) spermicidal vaginal preparations; (3) mechanical devices, such as the cervical cap; (4) douching preparations in the form of tablets, liquids, and powders; and (5) elaborate calendars and slide-rules to be used with the "rhythm" method.

BIRTH CONTROL

The term "birth control" is the most widely used today as a description of the prevention of conception. From the viewpoint of public hygiene, it has several merits worthy of mention. However, some confusion has arisen between birth control and abortion. An abortion is the destruction of a fertilized ovum, a life

already started; whereas birth control prevents the beginning of life by keeping sperm and ovum separated. It should not be confused with abstinence from the marriage act. It is essentially a means of prevention of conception or fertilization of the male and female elements necessary to new life. Sterilization in its usual sense is the permanent prevention of conception in one or both of the partners. It is a radical means of control and is used only in certain instances where the welfare of the parties concerned is to be considered.

Under certain circumstances it would seem that the control of birth is warranted as a means of safeguarding the health of the woman or of society in general—namely, for hygienic reasons. To enumerate a few of the more important conditions in which birth control may be of value, we can include the following:

1. Obstetrical and gynecological abnormalities which would endanger the life of the woman if pregnancy were to take place, such as deformities of the pelvis, eclampsia, history of pernicious vomiting in previous pregnancies, recent delivery or abortion, and the presence of a toxemia.

2. Some heart diseases.

3. Pulmonary tuberculosis, or tuberculosis active in other viscera or tissues.

4. Venereal infections and other diseases such as toxic goitre, diabetes, severe malnutrition, extreme obesity, and general debility.

5. Certain nervous and mental diseases such as epilepsy, insanity, and feeblemindedness.

The last mentioned reason rightly belongs in the field of Eugenics. The science of Eugenics is a system of improving the human race by selecting superior individuals for breeding purposes, and the prevention of breeding by inferior individuals. However, this is purely theoretical as far as the human race is concerned because in the case of feeble-mindedness alone the

potentialities for future hereditary tendencies is so greatly dispersed among the population that if every feeble-minded individual in the United States were sterilized tomorrow, it has been estimated that some 3000 years would be necessary to decrease the ratio to one in ten-thousand from a rate of one per thousand, a negligible decrease.

Not only may birth control prove meritorious for the above mentioned reasons of personal or public health, but also may be included for economic and social reasons. It enables married couples to have no more children than they are able to adequately provide for. It also has a powerful bearing upon the psychological health of a married couple. If this health be impaired by worry, anxiety, and fear, a condition common to thousands of married couples, it cannot but have a pronounced effect upon community and public health. It may free young people from the economic necessity of postponing marriage until a time when they can assume the added responsibility of offspring. It helps to eliminate the evil of the tremendously widespread "abortion-racket" with its sequelae of untold suffering and disease, since the majority of clients of abortionists are married women who through economic or other reasons are forced to undergo criminal abortions. Finally, it is a demonstrated fact that proper spacing of pregnancies reduces both maternal and infant deaths, an interval of two years between pregnancies being recommended for the welfare of both mother and child.

CHAPTER VI

Hygiene of Pregnancy

A state of pregnancy is not a state of disease; rather, it is a natural process of life based upon natural laws of self-perpetuation. Its management is mainly one of conformity with the laws of Nature. In my classes in Obstetrics, I stress the great value of Chiropractic as applied to the prenatal care of the mother and the gratifying results one may obtain in assisting nature to develop a new life with a minimum of discomfort to the maternal organism. The possibilities existent in such a practice are indeed far-reaching in that actual clinical records and statistics bear out the singular decrease in the prevention of the major complications of pregnancy, namely, toxemias and dystocia.

The average woman who visits a chiropractor regularly during her period of pregnancy may well expect the utmost in prevention of hypertension and albuminuria, both of which are prodromal of impending toxemia. A condition of eclampsia is most uncommon when under chiropractic care. Even the presumptive sign of pregnancy, called morning sickness, may be absent entirely, or if present, nothing more than a mild nausea. Parturition is made much easier and decreased in time when the forces of labor and the factors of delivery are at their highest peak of efficiency due to scientific chiropractic care.

From a practical viewpoint then, the pregnant woman is undergoing a natural phenomenon, and, as such, is in need of natural forces to assist in the completion of this function. Chiropractic offers the most important basis of maternal hygiene; it is the keystone upon which is built a general mode of life without any need for radical changes. If she will follow certain nat-

ural methods of living, and visit her chiropractor at designated intervals, pregnancy may well be a period of ease and contentment rather than one filled with fears and tribulations.

DIET

The pregnant woman needs no special system of diet. What she does have need of is plenty of nutritious food of proper quality and quantity, sufficient for her own needs and the requirements of the life developing within her uterus. Sleeplessness and nervousness in a pregnant woman are oftentimes the result of an empty stomach. Water and fruit drinks may be used in large amounts to assist in normal excretory functions. It is well for the woman to accede to innate cravings for a particular type of food which is nothing more than an inherent demand for more foodstuffs of a specific nature not being adequately supplied in every-day meals. Pica is the sounding board of malnutrition and should be heeded, even if it means the ingestion of common soil from the garden.

It is best that the Innate Intelligence be scrupulously allowed full rein as regards dietary demands, because an attack of acute indigestion may be brought on by heeding the wishes of Educated Mind and such a gastric upset may be a serious matter, with abortion as the consequence. Sweets and desserts are to be taken with moderation and alcohol should be avoided. Due to the heavy demands for lime salts at this time to assist in the bone development of the fetus, it is advisable that an adequate amount be available through milk or similar foods. Red meats should be limited to one meal a day because of their heavy demands upon the organs of elimination.

FRESH AIR

The pregnant woman should have an abundant and constant supply of fresh air. She should avoid public gatherings or other

locations where poor ventilation may be present. A regular period should be spent out-of-doors each day, and at night the bedroom should be well ventilated. Since she is providing oxygen for her own body and that of her child, it is obvious that fresh air is one of the prime requisites of good hygiene.

EXERCISE

In the normal pregnancy, exercise is of great value in maintaining the health of mother and child. It should be carried out at daily intervals and may be continued right up to the time of confinement. Walking in the out-of-doors is the best form of exercise provided it is not carried to the point of fatigue. Walking tends to assist in parturition by expanding the uterine cervix and helps in the descent of the fetus.

Varicose veins may develop if the case must stand in one place for long periods of time so such activity must be curtailed. She should never attempt to lift or move heavy objects such as furniture, because of danger of miscarriage or premature labor and all violent exercise must be suspended. Tennis, bowling, horseback riding, or long train or automobile trips are to be avoided if possible, particularly in the second and third trimesters.

Mild or passive gymnastics may be performed indoors daily in the event that circumstances will not permit a daily walk in the open air.

SEXUAL INTERCOURSE

Moderation and restraint as regards sexual intercourse must be practiced during pregnancy. It is not advisable, and may well be dangerous, after the fourth month of gestation because of the possible interruption of the pregnancy if the person suffers from habitual abortion; or it may increase vomiting to a point of becoming serious, i.e., pernicious vomiting. In the last months, it should be avoided altogether as it may cause infection, or dislodge an unsuspected condition of placenta praevia.

SLEEP

Sleep of sufficient quantity is vital during pregnancy as it assists in the rebuilding of the nervous system which seems to be the greatest sufferer. Nervousness and melancholia may be greatly decreased by adequate sleep, augmented by regular rest periods during the day. The amount necessary will vary with the individual but eight hours each night is recommended for the average case.

BOWEL ACTION

It is necessary that the prospective mother be made aware of the importance of normal bowel action during her period of gestation. In most cases, the drinking of water in the amount of eight glasses daily will assist the action. Those cases under chiropractic will rarely experience any serious difficulty with the bowels and the use of purgatives is to be discouraged.

Under no circumstances should the case be allowed to self-administer castor oil, because of the danger of abortion, miscarriage, or the induction of labor. Oftentimes a single dose of castor oil may be sufficient to start labor because the castor bean has long been known as a powerful emmenagogue and is often referred to as the "poor woman's ergot."

CLOTHING

Clothing should be comfortable and of such a nature as not to interfere with the circulation. Garters and garter belts should be discarded during pregnancy because of the risk of vascular constriction with possible production of varicosities. Stockings and skirts should be suspended from the shoulders or from a properly constructed obstetrical garment. In the last months of pregnancy, the case may find an abdominal binder to give just the needed support to keep from becoming fatigued. An ordinary corset should not be worn after the third month because it may interfere with pelvic circulation and respiration.

A brassiere may give relief from fatigue as it supports the breasts, but it should be properly designed to prevent nursing difficulties in the post-partum period.

Comfortable, well-fitted shoes with low heels are advisable, as high heels may cause fatigue and backache by causing an imbalance of the body weight. Also low heels are less apt to cause serious falls which may result in trauma to both mother and child.

The clothing should be of proper weight for the season and temperature; she should not be chilled or overheated. One should not lose sight of the mental "lift" which comes when attractive maternity garments are worn instead of the ill-fitting smocks and other obvious maternal clothing one sees so often.

CARE OF THE BREASTS

This is one of the most important phases of maternal hygiene, because on it depends the welfare of both the mother and child. Good hygiene of the breasts in the pre-natal period may often mean the difference between a breast-fed child with its natural advantages, as contrasted with a child fed artificially because of lactation difficulties.

Proper care of the breasts should be instigated at about the seventh month. The breasts first begin to secrete a thin, watery fluid which oozes out upon the surface and forms crusts, which, if allowed to remain, will cause tender skin and possibly cracking when the child attempts to nurse. The best care is the daily washing of the breasts with soap and water.

If the nipples are not sufficiently prominent, i.e., retracted or inverted, a breast pump may be used during the latter weeks of pregnancy.

DENTAL CARE DURING PREGNANCY

An old adage in maternal hygiene has it that "For every child, a tooth." This need not be so if the mother exercises good judg-

ment in supplying the extra calcium and phosphates necessary to build sound bones and teeth for the developing child. The teeth should be carefully and regularly brushed. Foods rich in phosphates should be eaten regularly; such articles as oatmeal and whole wheat bread are needed in abundance.

At the beginning of pregnancy, it is advisable that the mother consult her dentist and have the teeth cleaned, all cavities filled, and other repairs made.

BATHING DURING PREGNANCY

Regular bathing is perhaps more important during pregnancy than at any other time because of the tonic and invigorating effect of the daily bath. Daily baths assist in stimulating the elimination of toxins through the skin and thus decrease the strain upon the kidneys. Baths are best taken at night before retiring, in warm water followed by a brisk towel rub. The woman should avoid chilling the body because this tends to decrease cutaneous elimination. Cold baths, cold sponges, surf bathing, and cold showers should be forbidden during pregnancy.

During the last trimester of pregnancy, a sponge or shower bath is to be preferred to a tub bath as the latter is attended with possible dangerous falls getting in and out. The entrance of water into the vagina may be detrimental.

MENTAL HYGIENE DURING PREGNANCY

We have found that under Chiropractic pre-natal care, many women feel better than at any other time during their lives. This is not the rule, however, and most women are subject to periods of depression and nervous irritability, and these variations demand much patience and forebearance on the part of both the patient and husband, and other members of the family. She should endeavor to retain her outside interests insofar as possible and to combat these periodic tendencies towards mental upheaval. As for the other members, they should keep in mind

that pregnancy and its attending discomforts may produce profound effects upon the maternal mind, and act accordingly to anticipate her desires as much as it is practical. Her wishes should not be met with attempts at repression and arguments.

Oftentimes a brief vacation or change of routine may be advisable; however, the case should not be allowed to "hibernate" away from friends and activities during the period of gestation.

BLOOD PRESSURE AND URINALYSIS

These two procedures constitute an important phase of prenatal hygiene because by their regular determination much may be learned of impending danger from eclampsia or other toxemias. Most states require that these two findings be recorded at regular intervals, preferably each month.

The urine should be examined to determine the amount passed each twenty-four hours as a considerable diminution in the amount of urine passed is more serious than the possible changes in its composition. Albumin in the urine is also closely observed because of its possible significance of impending kidney failure. The so-called "physiological trace" considered normal in most specimens, is usually absent in cases under Chiropractic prenatal care. A case under regular chiropractic care need not be concerned with albuminuria unless a serious condition of kidney disease was present prior to the onset of pregnancy.

Blood-pressure should be determined at least every month in the first six months of pregnancy and every two weeks thereafter. The normal range during pregnancy is from 110 to 130 mm. of Mercury systolically and from 60 to 90 mm. in the diastolic range. The finding of a blood pressure over 150 mm. is a serious sign, and may indicate that the child is dead or that a toxemia is developing. The blood pressure drops during the first two months and then rises gradually to a normal level as pregnancy progresses.

WEIGHT INCREASE DURING PREGNANCY

The routine weighing of the mother at regular intervals during pregnancy will serve as a guide in regard to increasing or decreasing the amount of food being ingested. At first the average gain in the fetus is one gram daily; nine-tenths of the weight is gained after the fifth month and one-half of the weight of the baby is acquired in the last eight weeks. Restricted diets, as generally used, do not greatly affect the size of the baby. To make the baby smaller than normal, it would be necessary for the mother to restrict her diet so severely that her health and that of the baby would suffer. On the other hand, a woman who gains an excessive amount of weight during her pregnancy is apt to have a large baby with attendant difficulties during parturition.

CHAPTER VII

Relation of Bacteria to Disease

Bacteria are an ever-present part of our environment. They exist in the air we breathe, the food we eat, and the water we drink. They are found on the surface of the earth, and for some miles in the air. They constitute an integral part of our existence from birth until death. Most of these micro-organisms are beneficial to man, in fact, many of them are essential to human life. There are about two thousand species of bacteria, and of this number, only about one hundred are associated with dis-ease. The remainder are active in soil reactions, dairy industries, and other beneficial processes.

At first glance, it would seem that the Chiropractic and Medical professions are separated by an unbridgeable gulf on the question of bacteria and disease production. Actually, such is not the case. Chiropractors do not flatly maintain that germs are incapable of bringing about disease. We know as well as does the pathologist that germs exist. We have seen them under the microscope too, and we do not deny their presence in specific infections—the gonococcus in gonorrhea, or the typhoid bacillus in typhoid fever. We are not surprised to find these organisms present in such diseases, but we do maintain they are the result of the disease and not the cause of it. Chiropractors maintain that certain bacteria may bring about symptoms of disease when they secrete definite poisons which are detrimental to the human body. These toxins are the result of bacterial metabolism; in other words, endotoxins and exotoxins, the same toxins as liberated under the medical theory of germs causing disease. Before germs can cause any tissue changes in the human body, they must find suitable environmental factors for their continuous growth and multiplication. Since normal healthy tissue cells

are not suitable culture media for such activity, germs are incapable of causing disease. If present, they are pleomorphic, or attenuated, or dormant. But should the tissue cell lose its normal healthy state and undergo a change in its metabolic processes, it may provide conditions admirably suited to the growth and multiplication of bacteria. These bacteria, in turn, may secrete or excrete substances destructive to the human body and a state of dis-ease is said to exist. When the tissue cells regain normal nerve supply by removal of interference to transmission of mental impulses, then a condition exists which is intolerable to the organisms and health is restored. In other words, *the Chiropractic concept of bacteria is that they are scavengers of dis-eased tissue and when this dis-eased tissue no longer exists, the bacteria will languish from lack of proper circumstances for their continued growth.*

This concept of dis-ease and pathogenicity of so-called infectious bacteria is well-formulated and coincides with the more advanced understandings of immunology and bacteriology. Thus, the chiropractic understanding of bacteria and their relation to disease has been formulated empirically, but research has since proven its sound position.

The fundamental basis of all bacterial pathogenicity is considered around four key factors influencing the occurrence of infection—namely, route, number, virulence, and resistance encountered—and these fundamentals are the strongest possible arguments for Chiropractic philosophy concerning the germ theory.

INFECTIONS

Whenever bacteria enter the human body and find sustenance of the proper quantity so that they may multiply and produce toxins deleterious to tissue, this condition is referred to as an *infection.* The animal body serving as the host to this state of

affairs is said to be *infected.* Any disease associated with pathogenic bacteria is called an *infectious disease.*

INFESTATION

Infestation is invasion of the body by animal parasites. Because bacteria are forms of plant life, it is not correct to refer to a bacterial infection as an infestation. This term is properly reserved for a disease process associated with animal parasites only, such as an infestation with tapeworm or hookworm.

CONTAMINATION

Contamination infers the presence of infectious organisms without an actual infection existing; for example, the handkerchief of the patient and the hands of the Chiropractor may be contaminated with the tubercle bacillus in caring for a case of pulmonary tuberculosis.

INFECTION ATRIA

The channel through which certain bacteria are able to enter the human body and set up reactions under given conditions of lowered tissue cell resistance is spoken of as an infection atrium. These channels include ingestion, through the skin, open wounds, the respiratory tract, or the glands of the skin. These atria are more or less specific for the organism in question. For example, the tetanus bacillus with its potent toxins may be ingested with safety but produces serious reactions when it enters the broken skin as in a puncture wound. Yellow fever, for example, is never contracted otherwise than by direct inoculation into the body by mosquitoes. Many diseases heretofore considered as transmissible through the air have since been placed in the category of being only slightly contagious under such circumstances; pneumonia is a good example of this. Typhoid fever bacilli may

produce typhoid fever when swallowed, but when inhaled or rubbed on the surface of the skin are impotent; on the other hand, staphylococci may be swallowed with impunity, but when rubbed on the skin vigorously, may bring about such skin lesions as furuncles or abscesses.

DROPLET INFECTIONS

By droplet infections we refer to the harmful reactions following a discharge of infectious organisms in the act of sneezing, coughing, or blowing. These microscopic particles are carried about by the air currents and may settle in the eyes, on the skin, or penetrate the respiratory system. The possibility of droplet infection is omnipresent in our everyday lives; in the home, office, factory, theater, or restaurant, we are constantly beset by currents of air which may contain microorganisms potentially dangerous to health. The only practical method of control of such a menace is to maintain a sound healthy body, with its natural defensive forces at a high peak of efficiency. What better method of assisting an individual to escape droplet infections than a regular periodic checkup by a chiropractor?

DIFFERENTIATION OF INFECTIOUS AND CONTAGIOUS DISEASES

A disease is said to be either infectious or non-infectious. An infectious disease is one associated with a micro-organism, and a non-infectious disease is one not caused by bacteria, or any external agency. Many of the more common diseases are infectious in nature. For example, diphtheria, tetanus, typhoid, malaria, infantile paralysis, tuberculosis, pneumonia, gonorrhea, any many others are included in this group. Among the more common non-infectious diseases are diabetes, chlorosis, Bright's disease, cardiac arrythmias, etc.

Any article other than food which harbors an infectious organism is referred to as a fomite, or fomes, and is said to be

infective; whereas a vector is any organic matter or living animal which may transmit disease germs from one host to another. In a broad sense then, an individual might become infected with gonorrhea from a toilet seat, the fomite, and later act as a vector in spreading the infection to a second person by sexual contact. Infectious diseases may be either contagious or non-contagious, but all contagious diseases are infectious, that is, caused by bacteria. A contagious disease is one that is readily transmitted by direct or indirect contact with the infected individual. The venereal diseases, tuberculosis, pneumonia, smallpox, and the measles, are a few examples of contagious dis-eases. Among the non-contagious but infectious diseases may be included malaria, yellow fever, and tetanus.

CARRIERS

Certain contagious diseases may be transmitted by human carriers who are persons harboring pathogenic agents in their bodies, but who show no signs of the illness usually associated with the specific bacteria present. They may be constantly discharging these organisms from their bodies. Convalescent carriers are those who harbor a specific organism during recovery from the dis-ease brought about by the organism, such as in typhoid fever, diphtheria, pneumonia, infantile paralysis, and cerebrospinal meningitis. A passive carrier is a person whose body harbors the pathogenic organism without having had the disease associated with the specific organism found in his system. They are sometimes called healthy carriers and may transmit virtually the same dis-eases as convalescent carriers. An active carrier is one who harbors the organisms of his particular disease long after the dis-ease symptoms have disappeared, sometimes referred to as a chronic carrier. When the individual discharges infectious material by way of the mouth, he is called an oral carrier, and when by way of the intestinal tract, an intestinal carrier.

Carriers are mentioned as a possible factor in the production of epidemics. Their degree of importance in producing widespread disease would depend upon the number of carriers, and the length of time they remain infectious.

EXIT CHANNELS OF PATHOGENS FROM CARRIERS OR OTHER INFECTED INDIVIDUALS

Most infectious dis-ease organisms are discharged from the body of the infected person by way of specific channels depending upon the organism present. For example, the following body discharges, or fluids, may contain the organisms associated with a particular disease:

a. Semen—gonorrhea.
b. Feces—typhoid, cholera, etc.
c. Sputum—tuberculosis and pneumonia.
d. Urine—typhoid.
e. Nasopharyngeal secretions—diphtheria, streptococcic throat, etc.
f. Sweat—typhoid.
g. Epithelial desquamations—smallpox.
h. Blood—malaria.
i. Saliva—Vincent's angina. TRENCH MOUTH.

INSECTS AND THE TRANSMISSION OF DISEASE

Insects act as conveyors of certain dis-eases, either mechanically or biologically. By mechanical means, they collect the organisms on their feet and other parts of the body, and carry them from place to place. In this manner the common house fly carries typhoid and dysentery. In some instances, they may bite the individual and infect him with the pathogen, as the flea in the transmission of the plague. When acting as a biological carrier, the insect acts as an intermediate host in that his body serves as a place for part of the life cycle of the organisms. Bio-

logical transmission of the following diseases is considered to be possible: Rocky Mountain Spotted fever, filiariasis, dengue, kala-azar, malaria, yellow fever, and typhus fever.

Insect control is essential to the preservation of health, particularly in tropical climates, because they serve as hosts to infectious organisms or as mechanical carriers of them. The following are the more common insects and the dis-eases they are said to transmit:

1. Flies—the house fly (Muscae domestica) is the most extensively distributed of all insects and is in constant contact with man. They live upon, and breed in putrid material of all types—garbage, feces, manure, and other wastes, and thus may contaminate many seemingly pure foods in their devious travels. The most common bacteria transmitted by flies are those associated with intestinal diseases—typhoid, dysentery, and protozoan dysentery.

A properly conducted system of fly control should include the elimination of their breeding places by proper sewage and garbage disposal systems. Screening of doors and windows will help, as will traps, swatters, fly-papers, and poisons.

2. Mosquitoes—are, for the most part, vectors of infective agents by biological means. They may spread certain diseases by furnishing a biological link between the well person and the person ill with a specific dis-ease. Diseases transmitted by mosquitoes are: Dengue fever, malaria, yellow fever, and filiariasis.

The control of mosquitoes is best effected by destroying their breeding grounds and habitations, and since this is usually in water, the draining or oiling of such water will materially decrease their numbers. Screening and the use of certain mosquito repellants may also assist in their control.

3. Fleas—are agents which may transmit plague and endemic typhus fever. The most notorious carrier of the plague organism is the flea associated with rats. In order to control such a transmission possibility, it is necessary to employ proper rodent con-

trol, as well as any areas infested with fleas. If a building or room is infested with fleas, fumigation with hydrocyanic acid gas or sulphur dioxide is effective. The room is then swept, and the sweepings burned.

4. Lice—The body louse, pediculus vestimenti, bites the extremities of individuals and leaves irritating and itching lesions. Their eggs, or nits, are laid under the seams and folds of clothing, thus making it difficult to eradicate them except by measures which would include the delousing of clothing. They are known to carry the following dis-eases from one individual to another: Typhus fever, Trench fever, and Relapsing fever.

The best protection against lice is cleanliness of the individual and the home. In the event that a person becomes infested with lice, he must be deloused; which consists of passing his clothing through steam delousers, and exercising scrupulous personal cleanliness in the future.

Lice which are confined to the hair of the head are called Pediculus capitus and their control is based upon close cropping of the hair and rubbing the scalp with equal parts of kerosene and olive oil after which the hair is washed thoroughly with soap and water. Finally, vinegar is placed upon a comb and the hair is combed vigorously to remove the nits.

Pubic lice are commonly called crabs, and are present in the pubic hair of infested individuals. The control of the Pediculus pubis is essentially the same as for the head louse. Various proprietary preparations such as Blue Ointment are available for control of the pubic louse.

5. Ticks and Mites—may act as carriers of the following dis-eases: Rocky Mountain Spotted Fever, Tsutsugamushi Fever, Relapsing Fever, and Tularemia. Since these ticks are found most commonly on the bodies of certain animals or on certain bushes and other plants, the prevention of dis-eases spread by them is based upon careful inspection of the clothing and the body after passing through tick or mite-infested areas, also upon exercising

Scrub typhus

caution in handling the carcasses of such animals known to be infested. Occasionally, large areas of underbrush known to harbor ticks should be burned over as a preventive measure.

ANIMALS AND THE TRANSMISSION OF DIS-EASE

Certain of the lower animals, including arthopods and birds, may suffer from a number of dis-eases which are transmissible to man. In some instances, these animals merely serve as hosts to the pathogenic organisms without contracting the dis-ease themselves. The principal animal hosts include rodents, parrots, fowl, cattle, sheep, swine, dogs, and horses. Perhaps the most outstanding of these hosts is the rat, because of its prevalence and the severity and number of the dis-eases it may transmit.

Rat Flea man.

Rodent control is essential, because rodents, especially rats, act as hosts for the rat flea and convey the plague and endemic typhus fever. Since rats are prone to inhabit buildings occupied by man, the opportunity for the spread of such dis-eases is great, and control of the rat is of supreme hygenic importance. Obviously, the best method of control is to maintain such a high standard of sanitation in the home and the community that rodents will not be attracted. If they are already present, steps should be taken to eradicate them. All buildings should be rat-proofed, and should be constructed of materials not easily destroyed by rats. Food-stuffs should be properly protected in closed containers; garbage and other refuse should be collected regularly so as to decrease its accessibility to rats.

Fumigation with hydrocyanic gas is the best method of controlling rats because it also kills the fleas and lice on the rats. Rats may be trapped, but this is a slow and laborious method of dealing with the problem. Rat poisoning is another method which may give some results on a small scale.

ANIMAL-BORNE DIS-EASES

The following dis-eases are those most commonly associated

with an animal host. The name of the animal transmitting the infection is included after the name of the dis-ease, as well as the more salient features of the condition.

1. Typhus Fever—(Rats). Typhus Fever occurs as both Old World and New World Typhus with the latter being endemic in Mexico and the Southwestern United States. The reservoir of infection is in rats and the infection is transmitted by the fleas on the rat. Typhus is a dis-ease peculiar to wartime conditions when the stress of warfare makes normal hygiene and sanitation virtually impossible. The dis-ease attacks suddenly and with severity. Red spots appear over the entire body along with chills and fever. The mortality rate is high, about 50 to 70%. The specific organism associated with typhus fever is a peculiar bacillus called the Rickettsia prowazeki.

2. Plague—(Rats and ground squirrels). The Plague is a dis-ease known since olden times, which, during the Middle Ages, was called "the black death" or "the great death." A very high mortality rate was prevalent until recent years and it swept across countries in severe epidemics. It occurs in two principal forms: the bubonic, and the pneumonic, with the former being more common. The bacteria associated with the malady is the Bacillus pestis or Pasteurella pestis, which is transmitted from rat to rat by the bite of the rat flea. Man contracts the plague from the bite of such a flea. The disease is characterized by hemorrhages which, when affecting the skin, cause black splotches which give it the name of the black death. In our own country the plague has been encountered in California, Texas, and Louisiana.

3. Relapsing Fever—(Rats, and insects). Relapsing Fever is an acute infectious disease caused by certain spirochaetes and characterized by repeated febrile reactions with intervals of total remission. It is transmitted by such biting insects as lice and ticks, which may be harbored by the rat.

4. Rat-bite Fever—(Rats). Rat-bite fever is a specific infec-

tious disease due to a Spirillum which occurs primarily in rats and is spread to man by the bite of the rat. It is not fatal but there appears an ulceration at the site of infection, along with fever and a skin eruption.

5. Tularemia—(Rats, squirrels, and rabbits). Tularemia is also known as "rabbit fever" or "deer-fly fever" and is an infection following one of three different courses: the ulceroglandular type, the oculo-glandular type, and the typhoid type. The Pasteurella tularense is the specific organism associated with the dis-ease, and is directly transmitted to man by the bite of the horse fly, or a wood tick. The dressing of infected rabbits is given as another mode of infection. The Pasteurella tularense is known as the most easily communicated of all the pathogenic organisms.

6. Spotted Sever—(Rodents). Rocky Mountain Spotted Fever is an infectious disease bearing a close resemblance to Typhus Fever and is also caused by a member of the Rickettsia group. It occurs mostly in the Rocky Mountain States such as Idaho, Montana, etc. The dis-ease is directly transmitted to man by the bite of a wood tick which may be harbored by a rat or other rodent. It is characterized by a fever and the appearance of a petechial eruption on the wrists, ankles, and back, later becoming generalized. The mortality rate is moderately high, about 20% on the average, but in the Bitter Root Valley of Montana it may reach 90%.

7. Undulant Fever—(Goats and cattle). Undulant fever is variously known as Malta Fever, brucellosis, brucelliasis, and goat fever. It is a systemic infection resulting from the handling of infected cows, or goats, or pigs. In most cases, the infectious material is derived from the tissues of a dead animal and enters the body through cuts, or abrasions in the skin. Man may also become infected by eating infected dairy products. The dis-ease is characterized in man by a remittent undulatory fever with frequent remissions, neuralgic pains, increase in size of the spleen,

profuse sweating and chills, prostration, and anemia. It is supposedly due to the Brucella melitensis.

8. Anthrax—(Cattle, sheep, goats, horses, and hogs). Anthrax is popularly called "Wool-sorter's disease" and is one of the most highly contagious dis-eases transmissible from animals to man. It is primarily an occupational dis-ease confined to those who handle animals or their products, such as hides and wool. Cheap shaving brushes have been mentioned as a possible source of the bacillus. It manifests itself in two distinct forms: first, external anthrax which is characterized by a malignant pustular eruption, and second, the internal form which may attack either the respiratory or intestinal tracts. The Bacillus anthracis is the causative organism of the disease.

9. Psittacosis—(Parrots, canaries, and chickens). Psittacosis is an acute febrile disease of man which is highly fatal. It is acquired from such birds as parrots and canaries and is popularly referred to as "parrot fever." Its outstanding clinical feature is the development of a severe bronchopneumonia running a rapid course. The disease was not well known in the United States until 1929 when a mild epidemic broke out in some of the Western States, particularly California. The organism associated with psittacosis is the Rickettsia psittaci.

10. Tetanus—(Horses, cattle, and other herbivora). Tetanus is an infectious disease commonly called "lockjaw," which produces spasms of certain muscles due to liberated toxins acting upon the central nervous system. The tetanus organism, Bacillus tetanus, is introduced into the body by way of the skin when a puncture wound is suffered. It lives normally in the intestinal tracts of horses, cattle, and pigs.

11. Weil's Disease—(Rats). Weil's Disease is variously known as epidemic jaundice, spirochetal jaundice, or infectious jaundice. It is transmitted by way of the rat which serves as an intermediate host for the organism, Spirochaeta icterohaemorrhagiae. It is an acute infectious dis-ease characterized by fever, con-

junctival congestion, muscular pains, enlargement of the liver, and jaundice.

12. Tuberculosis—(Cattle and Hogs). Tuberculosis is a widespread dis-ease, sometimes referred to as the "white plague" and is essentially a disease of civilization. One of its most constant sources of infection is the milk of infected cattle and because of this, pasteurization is widely employed as a means of control. The Bacillus tuberculosis is the offending organism; and as well as being found in the milk of tuberculous cattle, may be present in the meat of such cattle, as well as in pork.

MAN TO MAN DROPLET. or SNEEZE.

13. Trichinosis—(Cattle and hogs). Trichinosis is discussed in the chapter dealing with parasitic protozoa.

14. Tapeworms—Cattle and hogs). Tapeworms are discussed in the chapter dealing with parasitic protozoa.

15. Glanders—(Horses and mules). Glanders is a dis-ease of horses and mules which is transmissible to man, particularly those individuals whose occupations place them in close proximity to the animals. Infection occurs either through the cutaneous route or by way of the nasal mucosa. In the acute form, there is a local nodular swelling with a spreading pustular skin eruption, and if chronic in its course, the respiratory tract usually becomes involved. This disease is said to be due to the Glanders' bacillus or the Pfeiferella mallei. Decrease in the use of horses for transportation is rendering the disease uncommon.

CHAPTER VIII

Common Tests for Disease

The testing of an individual to see whether susceptible or immune to a certain dis-ease has become an integral part of the study of immunity. These tests form the basis upon which inoculation may or may not be performed as a preventive measure, or whether or not treatment is indicated in a suspected case of a dis-ease. Because of the widespread testing being done to-day, particularly upon school children, it behooves the chiropractor to be conversant with the more common tests employed. The more common tests or reactions in widespread use are as follows:—

1. MANTOUX TEST—to detect the presence of an active case of tuberculosis. It is based upon the fact that persons infected with tubercle bacilli become sensitive to the tubercle bacillus and its product of tuberculin. When laboratory tuberculin is *injected between the layers of skin* an area of redness and swelling appears at the site of inoculation if the case is infected.

2. VON PIRQUET TEST—is very similar to the Mantoux test except that the tuberculin is *rubbed into scratches made on the arm* of the individual, and if positive, redness and swelling will appear.

3. TUBERCULIN PATCH TEST—An ointment containing tuberculin or filter paper saturated with tuberculin is held in place against the skin of the arm for 48 hours by adhesive tape. A positive test is indicated by redness and papule formation at the place of application.

4. SCHICK TEST—to determine whether or not a person has sufficient diphtheria antitoxin in his blood to make him immune to diphtheria. It is used to detect a person needing active immunization against diphtheria and also to tell whether or not such active immunization has been successful. The test is done

by injecting a small amount (1/50 M.L.D.) of diphtheria toxin between the layers of the skin. If the person is immune no reaction will occur, but if his blood contains insufficient antitoxin to neutralize the injection a spot of redness about one inch in diameter will appear at the site of injection within 24 to 36 hours.

5. DICK TEST—performed by injecting a diluted form of scarlet fever toxin between the layers of skin of the fore-arm. If a person is immune to scarlet fever his natural antitoxins will neutralize the toxin injected and no reaction will occur, but if he is susceptible to scarlet fever a small red area about one half inch in diameter will appear at the injected area within 24 hours.

6. SCHULTZ-CHARLTON PHENOMENON—is a test used to differentiate scarlet fever from other erythematous diseases such as measles, erythema, urticaria and rubella. In this test a small amount of blood serum from a person who has successfully convalesced from an attack of scarlet fever is injected between the layers of skin directly under a scarlet rash. If the rash turns white temporarily it indicates scarlet fever.

7. WIDAL TEST—used to detect the presence of typhoid fever. It is sometimes called the Gruber-Widal test and is performed as follows: a drop of blood from a suspected individual is mixed with a drop of 24 hour's old bouillon culture of typhoid bacilli and the mixture is observed microscopically. The bacteria gradually lose their motility and in 30 minutes will gather in bunches or clumps (agglutinate) if the test is positive.

8. WEIL-FELIX TEST—not a specific test for typhus fever but an agglutination reaction similar to the Widal test. The organism agglutinated is a member of the proteus group of bacilli. The reaction is an agglutination by the serum of typhus fever cases on a strain of Proteus organism isolated from the urine of a case of typhus fever. Thus even though the Proteus organism is not associated with typhus fever it will give an agglutination reaction with the blood serum of an active case of

typhus and the Weil-Felix test would be positive for typhus in such a case.

9. WASSERMANN TEST—is a blood serum test for syphilis, based upon the complement fixation procedure. Although the test entails a complex laboratory procedure, its principle is rather simple. The blood serum of a syphilitic has antibodies present which will react against the organism of syphilis. When this blood serum is mixed with a certain amount of complement (fresh blood serum of a guinea pig) and a suspension of spirochaetae, the three will enter into a reaction whereby the complement is fixed or destroyed. Since this reaction cannot be seen or otherwise detected it is necessary to add some substance which will show such a change. So, hemolysin and red blood corpuscles (sheep) are added to the original serum-complement-bacterial mixture: no hemolysis will occur if the complement which would activate the hemolysin (to destroy the red blood cells) has already been fixed or destroyed. This signifies a positive test or reaction. If hemolysis does occur the test is negative because it signifies that the original complement in the blood serum of the guinea pig was not fixed in the first reaction but remained available to cause hemolysis visible to the technician.

10. KAHN TEST—is a syphilitic test used as a control on the Wassermann Test. It is based upon the appearance of a white precipitate when an alcoholic extract of normal heart muscle is added to the blood serum of one afflicted with syphilis. It may be negative when a Wassermann is positive and vice versa.

11. KLINE TEST—is a microscopic slide precipitation test for the detection of syphilitic reagin. When blood serum from a case of syphilis is added to a specially prepared antigen solution and the two are observed microscopically there will be observed distinct agglutination consisting of coarse clumps appearing on the slide.

12. KOLMER QUANTITATIVE COMPLEMENT FIXATION TEST—is a modification of the Wassermann test based

on the same principle of complement fixation. However, the Kolmer test is designed for a more exact interpretation of the obtained reactions. It is also used in other fields of biology for the detection of gonorrhea, typhoid fever, tuberculosis and others.

13. ASCHHEIM-ZONDEK TEST—is used for the diagnosis of pregnancy by the use of an intravenous injection of the patient's urine into immature female white mice. If sufficient of the anterior pituitary pregnancy hormone is present in the urine there is a definite change in the ovary of the animal visible upon post-mortem examination.

14. FRIEDMAN TEST—is similar in principle to the Aschheim-Zondek test except that rabbits are used instead of white mice and the urine is injected into the ear vein of the animal.

15. BORDET-GENGOU PHENOMENON—was the original complement fixation test from which was evolved the Wassermann test. These two bacteriologists proposed this phenomenon of complement fixation as a diagnositic test for typhoid, tuberculosis, erysipelas, cholera, gonorrhea and meningitis.

16. CREDE TREATMENT—although not a test for disease, is so widely used as a public health procedure that it merits inclusion in this discussion. The eyes of the newly-born are treated with a 1% silver nitrate solution immediately after birth for the prevention of ophthalmia neonatorium (gonorrheal). It is a legally required routine procedure in about 90% of the states of the Union.

17. FREI TEST—is used to detect cases of Lymphogranuloma inguinale. It consists of the intradermal injection of sterile pus collected from the buboes of an active case of lymphogranuloma. The appearance of a bright red papule at the site of inoculation is considered a positive test.

CHAPTER IX

Immunity

Immunity is the resistance afforded by the host to the infective powers of invading microorganisms. This term is only a relative one, however, as many factors enter into the question of whether or not an individual is immune to a particular disease. Immunology, or the study of immunity, is a lengthy and complex series of facts and hypotheses. When followed through in its entirety, one cannot but be impressed by its simplicity and naturalness. Indeed, it coincides very closely with the chiropractic concept of immunity which states that immunity is the adaptative resistance of the tissue cells (constructive survival value). The ideal state of resistance, of course, is dependent upon the perfect transmission of mental impulses. Does it make any difference if the tissue cells make a complex antitoxin or bacteriolysin; or whether we employ the term antibody formation, or adaptative resistance? Chiropractors and immunologists agree that immunity is based upon the ability of the tissue cells to cope with the presence of organisms, and, as such, is dependent upon the degree of efficiency of the tissue cells individually and collectively.

FACTORS WHICH PREDISPOSE TO DIS-EASE

1. *Subluxations.* Any interference with transmission of mental impulses causing tissue cells to become unhealthy affords a favorable breeding ground for microorganisms. Unhealthy tissue cells serve as a source of nourishment for bacteria which, in turn, throw off metabolic wastes capable of poisoning the human body.

2. *Age.* Certain diseases are more easily acquired by children than by adults and vice versa. The grown person is only slightly susceptible to chicken pox and the child but slightly predisposed towards cancer.

3. *Malnutrition.* Hunger and thirst both decrease body resistance because they weaken the body. Improper or insufficient food may allow so-called commensal organisms to overcome the body defenses.

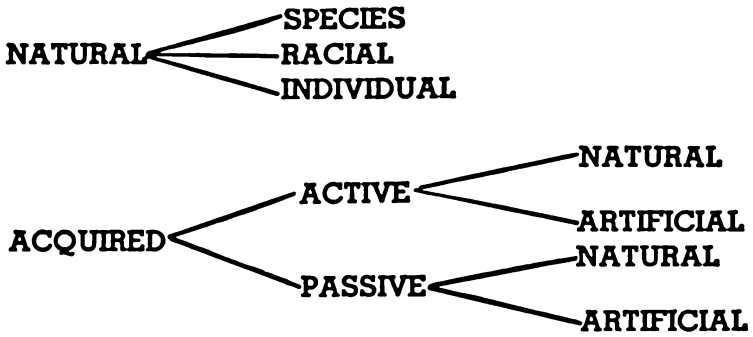
4. *Exposure.* Exposure to heat or cold (chills) may produce a more sensitive condition (lowered resistance) in humans adapted to normal temperature. Inadequate home heating is a form of exposure.

5. *Exhaustion.* Physical or mental fatigue carried to excess may favor the establishment of an infection. Certain debilitating diseases, such as cancer or tuberculosis, may so weaken the body defenses by exhaustion that the setting-up of a secondary infection is a relatively easy matter. Shock reactions, following physical or mental injuries, are also factors in weakening the ability of the human body to ward off infection.

6. *Hereditary factors.* It is important to differentiate between an hereditary disease and a congenital disease. A hereditary tendency or characteristic may be shown in such diseases as albinism, color-blindness, certain mental diseases, certain allergic conditions, and a disposition to such diseases as diabetes and gout. These characteristics have been imparted from parent to offspring and may be transmitted from one generation to the next, the same as red hair or blue eyes.

A congenital disease is one which is acquired during intrauterine life, but is not inherited. Club-foot, spina bifida, amputation of the head, or limbs due to constriction of the umbilical cord and other anomalies are examples of congenital conditions. Syphilis, from direct infection from the mother is mentioned also as a congenital disease in some instances.

TYPES OF IMMUNITY



Immunity may be classed primarily as either natural or acquired. A natural immunity is the type present from the time of birth and which lasts throughout the life of the individual. It may have been developed through species or race, or be inherited in the individual himself. On the other hand, an immunity established after birth is spoken of as an acquired immunity.

NATURAL IMMUNITY

Natural Species Immunity

Species immunity is that immunity peculiar to a certain species of animal. For instance, man does not have diseases of lower animals, such as hog cholera or horse distemper. Cattle and horses do not contract typhoid fever, and fowl do not get tetanus.

Natural Racial Immunity

Racial immunity is that possessed by a race. The classical example is found among sheep, in which we find ordinary sheep very susceptible to anthrax, but Algerian sheep highly immune to the disease. In a lesser sense, the negro is more resistant to malaria than the white, but the latter is able to withstand the onslaughts of tuberculosis better than the negro.

Natural Individual Immunity

Individual immunity is a condition difficult to explain aside from the natural resistive forces innate to man. Evidently it is based on the healthy functioning of all parts of the body; so, a person without nerve interference, and able to retain a state of health even in the presence of potent infective agents, can be said to possess individual immunity.

ACQUIRED IMMUNITY

Acquired immunity may be either active or passive. Acquired active immunity is that which is brought about by having a disease and building up in the body certain resistive agents. If artificially acquired, it is conferred by the injection of immune substances produced by another individual or animal. In other words, power of immunity is produced outside the body of the recipient: all he does is receive the benefit of the immune bodies. For example, if a person has an active case of diphtheria, he will build up in his system certain substances to combat future possible diphtheria attacks and so will have created an active acquired immunity. On the other hand, if he receives a "shot" of immune bodies produced by introducing the diphtheria organism into the body of a horse or similar animal, then the individual plays no part in producing immunity in himself and is said to have an acquired passive immunity.

Acquired Active Natural Immunity

This type of immunity is developed naturally in an individual having had an attack of a certain disease who afterward possesses a relatively strong immunity to that particular infection, as is the case in whooping cough, smallpox, etc.

Acquired Active Artificial Immunity

Vaccination is the basis for an acquired active artificial immunity. The vaccine contains dead or living organisms which

are inoculated into the body of the individual for the purpose of producing a mild form of the disease; thus the person builds up an active immunity, artificially acquired. Examples of this immunizing process is seen in vaccination against typhoid, diphtheria, smallpox, and rabies.

Acquired Passive Natural Immunity

This phase of immunity results from the transferrence of immune bodies by way of the placental blood circulation during intra-uterine life. It comes from the natural immunity of the mother, and is given passively to the developing child. It is upon this basis that the immunity of infants to smallpox, measles, diphtheria, and other diseases, is explained.

Acquired Passive Artificial Immunity

Immune serums are the substances injected to give an acquired passive artificial immunity. An immune serum is the serum of an animal or person that has been highly immunized to a specific infectious disease. Its primary purpose is to bring about a passive immunity by conferring upon the recipient immune substances produced in the diseased body of another person or animal. Its outstanding application is seen in the use of diphtheria antitoxin and tetanus antitoxin. The individual receiving the injection of the immune serum plays no part whatsoever in the production of the diphtheria or tetanus antibodies; he merely receives the benefits of the active immunization of the donor.

DIFFERENCE BETWEEN AN IMMUNE SERUM AND A VACCINE

A vaccine is defined as a suspension of virulent, attenuated, or dead microorganisms. It is usually modified in such a manner as to be able to promote the production of specific antibodies by the person receiving the inoculation, but cannot cause an outright case of the disease. It always produces an active immunity be-

cause the body of the inoculated individual must fight against the antigen or vaccine. Seemingly, they are most widely used to prevent disease rather than cure it, as shown in vaccination against rabies, typhoid, smallpox, tetanus, scarlet fever, and certain staphylococcic infections.

Immune serums are injected with the thought of producing a passive immunity. They already contain specific immune bodies which may successfully deal with a possible future contact with the disease. These immune bodies are all fundamentally the same as regards purpose, namely, producing immunity, but they may differ in their action. The following are the most common types of immune bodies found in immune serums.

a. *Antitoxic.* An immune serum which has been prepared against certain extracellular bacterial toxins. It acts specifically to neutralize certain toxins which may gain access to the body of such an immunized individual. It is always specific for the toxin against which it was prepared; for example, tetanus antitoxin present in immune serum will react only against tetanus toxin, and not against diphtheria. These antitoxins are used most extensively in the prevention of diphtheria and tetanus; but, in recent years, antitoxins have been prepared against erysipelas, botulism, and scarlet fever.

b. *Antibacterial.* These are immune sera capable of destroying bacteria. They are prepared by injecting a horse with the bacteria in question. The antibacterial substances produce by the horse are recovered in the blood serum of the animal. Such serums are used to combat meningitis, pneumonia, and bacillary dysentery.

c. *Antiviral.* Sera developed against the ravages of certain diseases associated with viruses. They are still somewhat in the experimental stage and to date have been used against infantile paralysis, measles, and yellow fever.

It will be noted that immune serums are prepared with three fundamental purposes: (1) to combat the poisons or toxins

liberated by bacteria, (2) to destroy the bacteria themselves, (3) to deal with the filtrable virus and its possible pathogenicity.

FOUR THEORIES OF IMMUNITY

For many generations man has wondered why some people are susceptible to certain diseases and others are not, even though both groups may be living under identical environmental circumstances and with all other factors equal. It was this question that prompted D. D. Palmer, the discoverer of Chiropractic, to break away from the time-honored school of thought that disease came from outside sources and to seek the answer in the workings of the human body itself. It has been the objective of B. J. Palmer, the developer of Chiropractic, to enlarge upon this theory of disease production, to such a comprehensive scope that, today, the Chiropractic profession upholds a more logical explanation for the primary factors of immunity than does any other scientific school of thought. Chiropractic teaches that disease comes from within. If the body cells are sick they may form fertile breeding grounds for micro-organisms which, in their processes of metabolism, may throw off poisons, or produce such circumstances as may be detrimental to the welfare of the body. The fact seems clear that the primary cause of a diseased state is due to the malfunctioning tissue cell, and not to the presence of the bacteria. If the body cells are functioning normally, they will be able to cope successfully with any organisms seeking sustenance in the body.

Four different theories of immunity have been advanced through the years. The first two of these have long since been disproved and the remaining two form the basis of present day immunology.

1. *The Exhaustion Theory.* This was based upon the observation that bacteria will not grow indefinitely in a given culture medium but eventually die. The explanation was offered that

the food supply of the organisms was exhausted. It was assumed that this happened in the body of an individual immune to a certain disease—that is, his system had not the proper food material to sustain the growth of the specific organisms and so he was immune. This was subsequently disproved by laboratory experiments which showed that bacterial growth stopped even though plenty of food material was available.

2. *The Noxious Retention Theory.* It was observed that bacteria, when grown on culture media, will in time stop growing, and it was thought due to the production of substances toxic to themselves. Of course, all cell growth produces wastes which must be removed if proper growth and metabolism is to continue and this observation was advanced as a theory of immunity —that the specific bacteria during their growth produced substances in the human body which were harmful to themselves. As time went on, this theory was dropped in favor of the following:

3. *The Phagocytic or Cellular Theory—(Metchnikoff's Theory of Phagocytosis).* This theory was evolved by the French immunologist, Mechnikoff, who believed that immunity was due to the presence of certain white blood corpuscles of the blood stream, called phagocytes, which ingest and destroy pathogenic bacteria. At the present date, his theory is advanced in conjunction with the fourth theory as the basis for immunology as we know it today.

4. *Humoral or Chemical Theory—(Erlich's Side-Chain Theory of Immunity).* Erlich, a German, advanced the theory that immunity in the human body is due to the development in the body fluids of certain specific substances which are able to combat the invading micro-organisms. These substances are known as antibodies or immune bodies. It is upon this concept that much of artificial immunization is based.

ANTIBODIES

Antibodies are substances present in the blood and body fluids, but very little is known of their nature or reactions. They result from stimulation produced by foreign substances entering the human body, but are not formed against every potential poison thus introduced. The most common substances, aside from bacteria and their products, which may give rise to antibody formation include snake venoms, certain vegetable poisons, proteins, blood serums and blood cells of species other than human.

The main method of classifying antibodies is based upon their action, and they fall into four groups.

a. *Antitoxins* are antibodies capable of neutralizing poisons or toxins.

b. *Precipitins* are antibodies capable of precipitating a clear filtrate of bacteria. These precipitins are specific; i. e., they will react only against the specific bacteria or protein matter which instigated their formation. They form the basis for certain tests to determine types of pneumococci. They are used at times to determine the type of blood stains present in a criminal investigation—whether human or otherwise.

c. *Agglutinins* are antibodies that have the power to cause organisms evenly suspended in a liquid to adhere to each other and form clumps. These bacteria are not destroyed; they merely lose their power of motility. This agglutination is a specific reaction in that it will occur only when the blood serum of an individual suffering from a certain disease is added to the suspension of the bacteria causing that disease. This phenomenon of agglutination is the basis for the well-known Widal Test for typhoid fever. In this test a drop of blood from the finger of the suspected case is mixed with a suspension of typhoid bacilli in dilutions of 1-20 and 1-40. The reaction is observed under the microscope and if the characteristic clumping occurs within thirty minutes, the test is positive for typhoid fever. Thus it may be seen

that the major value of agglutinins lies in the laboratorical uses for the diagnosis of disease and the differentiation of bacteria.

d. *Bacteriolysins* are special forms of antibodies which are capable of bringing about the solution, or lysis, of bacteria. They seem to be of considerable importance in the development of immunity to disease, and are built up in the system of an animal or individual who has an active condition of the disease. A case of cerebro-spinal meningitis is treated by inoculating into the patient specific bacteriolytic serum. This is obtained by inoculating a horse or goat with meningococci and then collecting the blood serum with its content of bacteriolysins.

One of the important substances found in bacteriolysins is called *Complement,* which is a component of fresh blood. Complement acts upon an antigen after this has been acted upon by its specific antibody. Such an antigen-antibody reaction is spoken of as "sensitizing" and during the antigen-antibody-complement reaction the complement is destroyed or inactivated. This is known as "fixation of complement" and forms the basis for such well-known complement fixation tests as the Wassermann and Kahn tests for syphilis.

PHAGOCYTOSIS

In Metchinkoff's theory of Phagocytosis, it was noted that he based the immunity of the human body upon the presence of certain cells capable of engulfing and devouring bacteria. These cells he termed Phagocytes. They are for the most part, leukocytes or white blood corpuscles. Although there are five or six different forms of leukocytes present in normal blood, the type most active in phagocytosis is the polymorphonuclear neutrophilic leukocyte. Not only are phagocytes capable of ingesting bacteria, but they may also clean up dead tissue cells, pigment, dust, minerals, and other foreign substances detrimental to the body. Pus cells are composed of dead leukocytes and

bacteria, with the latter appearing either intracellularly or extracellularly.

Phagocytosis seems to be dependent upon the presence of certain substances in blood serum called *Opsonins* which act upon the bacteria to prepare them for phagocytosis. The process of preparation is called positive chemotaxis. Opsonins seems to be specific for certain bacteria and will have no effect upon others and in this respect are closely related to the agglutinins, precipitins, and bacteriolysins.

The opsonin content of the blood may be determined as a means of measuring the resistance of an individual to a bacterial invasion. This determination is called the *Opsonic Index* and is based upon the amount of opsonin in the blood of a suspected case as compared with the amount in normal blood. The white blood cells are stained and examined microscopically and the number of bacteria counted in the first 100 cells; this number is then divided by the number of white cells which gives the average number per cell, or the opsonic index.

The degree of phagocytosis occurring when the white blood cells of a suspected case of a specific disease are mixed with a suspension of the bacteria associated with the disease, is called an *opsononcytophagic test* and may be used diagnostically in undulant fever and tularemia.

CHAPTER X

Hypersensitiveness

Closely related to the resistance of the body to disease is the phenomenon referred to variously as hypersensitiveness, hypersusceptibility, anaphylaxis, and allergy. In the past, these terms have been loosely used; but, of late, a definite understanding of each has been advanced.

Hypersensitiveness is the blanket term applied to both allergy and anaphylaxis, because the two are fundamentally very much alike.

Allergy is the term applied to the sensitive reactions of susceptible individuals when in contact with, or ingesting, a particular substance, usually protein in nature. Allergic conditions include such reactions as hay fever, asthma, and serum sickness.

The theory of allergy is based upon the assumption that an individual comes in contact with an activating substance and the body cells produce certain antibodies to combat this substance when next encountered. The individual is now said to be sensitized to the offending substance, which is given the name *allergen*. When the person next contacts this particular allergen, the antibodies in his system will react against it and the phenomena such as asthma or hay fever may occur.

1. *Hay fever* is associated with sensitiveness to pollens and the attack is confined to the time of pollination of the plants. It is said that in late spring and early summer hay fever is due to the pollen of grasses, and about 8 out of 10 cases are of this type. The early-spring type of hay fever is associated with the pollen from trees. Hay fever is also referred to as *Pollinosis* and may be due to contact with the following trees, plants, or grasses: Grass ragweed pollen (by far the most common), timothy, orchard grass, June grass, Bermuda grass, and Johnson grass.

Among the trees the most common offenders are elm, cottonwood, hickory, and maple.

A special type of hay fever occuring throughout the year is called *Perennial hay fever* and its most common causes are said to be animal dandruff, feathers, house dust, drugs, and plants which pollinate the year around

2. *Asthma* is also an allergic condition resulting from the inhalation or ingestion of certain proteinaceous matter. Chicken feathers, duck feathers, dog hair, cat hair, horse hair, and sheep wool are oftentimes blamed. In some instances, foods are mentioned as a factor in producing asthma, these including milk, cheese, fish, cereals, and certain meats and meat products.

3. *Serum Sickness* is the third outstanding example of allergic reaction to which the human body may be susceptible. It occurs rather frequently after an injection of an immune serum and although usually not fatal, it is very discomforting to the patient due to the severe itching, fever, glandular enlargements, edema, and other symptoms.

Generally the condition of serum sickness or serum intoxication occurs in individuals who have had a previous injection of some serum from a horse or other animal and are thus sensitized to the serum.

4. *Anaphylaxis,* in its true meaning, is the experimental hypersensitive state induced in laboratory animals by the introduction into their bodies of allergens. A suitable animal, usually a guinea pig or rabbit, is first injected with some allergen such as egg albumin and at the end of eight or ten days another similar injection is given with the production of severe anaphylactic symptoms, or anaphylactic shock as it is sometimes called. Anaphylaxis deaths have occurred from injections of immune serums. Many asthmatics are susceptible and may go into an anaphylactic reaction following such an injection. The reaction seems to confine itself to the smooth muscles of the respiratory and gastro-intestinal tracts.

TESTS FOR HYPERSENSITIVENESS

In some instances, a contact dermatitis may be traced to some substance irritating to the patient which produces symptoms of an allergic or anaphylactic nature. To determine this substance, the so-called *patch test* is used in which a small amount of the suspected substance is rubbed on, or injected into, the skin and if positive, a small red patch will appear within twenty to thirty minutes. Sometimes the material is held in place by adhesive tape. The usual tests are designed to detect a state of hypersensitiveness as regards chemicals, drugs, cosmetics, furs, and fabrics.

DESENSITIZATION

Because the theory of hypersensitiveness is based upon the presence of some allergen which is sensitizing to the individual, some work has been done to desensitize the individual by giving repeated small doses of the offending substances. It is used in the treatment of certain cases of urticaria, asthma, and hay fever.

CHAPTER XI

Sterilization and Disinfection

The bacterial cell, as is true of animal cells, is made up of a minute particle of protoplasm, or cell substance, consisting of a nucleus and cytoplasm. In order for this cell to live and function it is necessary that the delicate balance between the cell and its environment be maintained at a relative constant, thereby continuing its normal chemical composition and its *colloidal state.*

A substance is in the *colloidal state* when it occurs in such finely divided particles that they remain suspended in a suitable fluid indefinitely. The present-day concept of protoplasm by cytologists is that protoplasm is an aqueous colloid containing gases, fats, carbohydrates, and proteins, among other substances. The protein content of the cell is of particular importance in that it seems to determine many of the physiological activities of both bacterial and human cells. This proteinaceous material is susceptible to certain physical and chemical circumstances in that it undergoes *coagulation,* thus disrupting cellular function and bringing about the death of the cell. For example, carbolic acid or phenol is considered a good disinfectant; this based upon the supposition that it will coagulate cellular protein rapidly. Heat is a physical agent which seems to have the same effect. On this basis then, a disinfectant is a condition or substance which results in *the coagulation of protein or the formation of destructive chemical combination with the cells.*

DISINFECTION DEFINED

Disinfection is the destruction of all disease-producing organisms and their products. It does not include the destruction of

saprophytic or non-pathogenic organisms, thus the word does not mean that all organisms must be killed. Disinfection is usually accomplished by means of chemical agents known as *Disinfectants,* although disinfection of milk accomplished by *Pasteurization* is brought about by a heating process. A chemical in a solution of a certain strength may act as a powerful disinfectant while in a weaker solution its action may be that of an antiseptic.

FACTORS OF DISINFECTION:—These are:

1. Temperature
   Generally speaking, a disinfectant is more potent the warmer its temperature, supposedly due to the principle that chemical reactions are speeded up by raising temperature.
2. Concentration
   Germicidal action is directly proportional to concentration of the germicide, in most instances.
3. Duration of exposure
   A sufficient period of time is necessary for the lethal chemical reactions to occur in the bacterial cells.

PHENOL COEFFICIENTS

Standardization of disinfectants and antiseptics. The disinfectant or antiseptic powers of a chemical as compared with that of phenol (carbolic acid) is known as the PHENOL COEFFICIENT of the chemical. This comparison is made under identical conditions, on the same organism, and for the same length of time. A phenol coefficient of more than 1 is a stronger disinfectant than phenol and a coefficient of less than 1 is weaker than phenol. This procedure is an attempt to standardize the many commercial disinfectants being marketed as well as being useful in laboratory procedures. Ordinarily, it is based upon the

rate at which 5 cubic centimeters of a given disinfectant kills all the cells in a small drop of 24-hour broth-culture of Bacillus typhosus at 20 degrees Centigrade, as compared with the effectiveness of pure phenol under exactly similar circumstances.

The determination of a phenol coefficient is dependent upon a high degree of laboratorical skill and consequently is subject to discrepancies. The result is subject also to limitations because the substance being tested may be lethal to the typhoid bacillus with a phenol coefficient of 20, yet tested against another type of bacillus, say, the tubercle bacillus, would rate a coefficient of 1.5 or even less.

COMMON DISINFECTANTS (LIQUID)

1. Bichloride of mercury (corrosive sublimate) is one of the best general disinfectants. It is usually most lethal in a 1 to 500 solution but because of its corrosive action it cannot be used to disinfect metals, or be kept in metal containers. It has an irritant effect on the skin and must not be used except in the weaker dilutions.
2. Mercuric iodide (biniodide of mercury).
3. Mercuric cyanide.
4. Mercurochrome, used as a 2% solution for disinfection of wounds.
5. Metaphen, a mercury organic compound which is said to be nontoxic, nonirritating and nondestructive to metals or rubber.
6. Alcohol, a widely used disinfectant when in the concentration of 50 to 70%. Absolute alcohol has practically no disinfectant action.
7. Formaldehyde.
8. Ferrous sulphate (copperas) is a good disinfectant as well as a good deodorant because it combines chemically with ammonia and with hydrogen sulfide.
9. Potassium permanganate has strong powers of oxidation.

10. Lime is a good disinfectant when used as SLAKED LIME which is quicklime to which has been added one half its weight of water. Slaked lime or MILK OF LIME, is used extensively for disinfection of feces.
11. Chlorine enjoys widespread use in the purification of drinking water and swimming pools, the treatment of sewage and the disinfection of wounds. It is used as chlorine gas discharged from cylinders or as compounds which will liberate free chlorine. Chlorinated lime (bleaching powder or calcium hypochlorite) is a very efficient chemical which may be used to disinfect water and excreta and has the advantage economically of being a comparatively cheap substance.
    Dakin's solution is a neutral solution of sodium hypochlorite used in the strength of 0.4% to 0.5% for the cleansing of wounds.
12. Tincture of iodine is widely used as a skin disinfectant in the form of a 3% solution.
13. Phenol is an excellent disinfectant for pus, blood, sputum, feces and all general disinfection but is highly corrosive to the skin in strong solutions or crystals. It will not injure metals or fabrics.
14. Cresol is obtained from coal-tar. It is used in ¼ to 1% solutions and because of its saponaceous character is widely used for disinfecting the skin, lubricating the hands, and as a vaginal douche.

COMMON DISINFECTANTS (GASEOUS)

The use of gases as a means of disinfection is called *fumigation.* Not only are the gas disinfectants used to destroy pathogenic bacteria, but also to control certain insects such as mosquitoes, and body lice; and animals such as rats.

Fumigation as a means of disinfection has fallen into disfavor of late because of its limited application and doubtful efficiency.

It is specific only in very few instances and many forms of bacterial and animal life are not affected by the ordinary fumigants. Also, disease transmission is associated more with people than with objects and rooms so it is undependable. For example, fumigation of a room occupied by a person with the measles is said to exert no restraint upon the transmissibility of the disease. Formaldehyde is highly efficient in bacterial disinfection but has little effect upon small animals. Hydrocyanic acid is lethal to all forms of animal life but is not detrimental to bacteria.

The following are the most commonly used gaseous disinfectants or fumigants:

1. Formaldehyde. Several methods for the generation of formaldehyde gas are used. For a room of about 6000 cubic feet, 2 pounds of potassium permanganate is placed in a vessel of at least 6 gallons capacity and a mixture of one quart formaldehyde solution and one quart of water is poured into it. This chemical reaction produces intense heat and formaldehyde gas is liberated. Another method is the heating of paraform which breaks down into formaldehyde gas. Both these methods are accompanied by intense heat and the danger of fire must be kept in mind.

2. Sulphur dioxide. Sulphur disinfection requires the burning of four pounds of sulphur for each 1,000 cubic feet of space. The sulphur is broken into small pieces and mixed into a pan containing water. A small amount of alcohol is poured over the sulphur and ignited. This is effective for pathogenic organisms and for roaches, bed-bugs, etc., but it injures fabrics by bleaching them and metals by tarnishing them.

3. Hydrocyanic acid is one of the most potent destructive agents to insect and other animal life, but because of its extreme destructiveness its use is limited to the control of vermin in ships, warehouses, etc.

4. Carbon disulphide.

5. Carbon monoxide.

PROCEDURE FOR FUMIGATION:

Prepare the room to be disinfected by sealing all cracks, windows, and doors, except the one for exit, by stuffing with wet newspaper strips; open up and separate all books, clothing, etc., in the room and have wet paper ready to seal the last door when fumigation has been started and the operator is ready to leave. Windows should be left unlatched so they can be opened from the outside after the fumigation has been completed. Leave the seals unbroken for six hours, after which the room should be opened up and aired thoroughly. The temperature of the room at the time of the fumigation should not be below 70 degrees Fahrenheit. The prime requisite of all fumigants is the presence of sufficient water vapor in the air that the essential chemical combinations may take place.

SYSTEMS OF DISINFECTION:

Two systems of disinfection have long been recognized, *concurrent* and *terminal.*

The former concerns the hourly and daily attention to the disinfection of all things coming in contact with the patient; especially the body discharges and all that they might contaminate. The latter concerns the final disinfection of the patient's room after he has recovered from an attack, such as pulmonary tuberculosis, anthrax, and the plague. However, there should be no particular need for terminal disinfection in the great majority of diseases if concurrent disinfection has been faithfully carried out.

Radiant disinfection is a method of disinfection rapidly gaining widespread use as means of disinfecting the air in the home and public places, such as hotels, clubs, etc. It is used also in establishments dispensing foods such as restaurants and butcher shops. It employs the well known fact that the ultra-violet region of the spectrum is lethal to bacteria and so ultra-violet light

is used as a means of radiant disinfection of air. The principle has been employed for some time in the radiant disinfection of water by means of the Cooper-Hewitt mercury-vapor lamp.

REQUIREMENTS OF A GOOD DISINFECTANT:

In order for a disinfectant to be considered desirable it must have certain characteristics. Of course, no germicide has one hundred percent efficiency when considered from all the desired characteristics. The following are the most important features:

1. *Potency.* A good disinfectant has a high degree of germicidal power. In other words, it should have a high phenol coefficient, comparing favorably with the bacterial killing power of phenol.

2. *Homogeneity.* A good disinfectant should have a chemical composition of such a nature that it does not easily decompose and lose its efficiency. This stability is very important when the disinfectant is applied to organic matter because many of them have a tendency to combine with organic substances and form insoluble compounds.

3. *Non-toxic to higher life.* A satisfactory disinfectant should not be toxic to man and animals. This factor is difficult to obtain in most disinfectants because their lethal powers may be just as deadly to body cells as to bacterial cells.

4. *Non-bleaching and non-corrosive.* A good disinfectant is harmless to metals or fabrics.

5. *Cheapness and Availability.* A good disinfectant is made up of ingredients which are inexpensive and easily obtainable.

6. *Penetrating power.*

7. *Deodorizing power.*

8. *Solubility.* An acceptable disinfectant should have a high degree of solubility in water.

STERILIZATION

STERILIZATION DEFINED

Sterilization means the freeing of any object or substance from all life of any kind. This is usually accomplished by heat but in some cases may be done by the use of chemicals, radium or x-rays.

Heat, may be applied for purposes of sterilization in three different ways (a) by the flame, (b) by hot water or steam (moist heat) and (c) by hot air (dry heat).

Small objects that are not injured by thrusting them into an open flame may be sterilized by heating them to a red heat.

Boiling in water is a simple and efficient means of sterilization provided the object is boiled for a sufficient length of time. At least an hour is necessary for sterilization because many bacteria form heat-resisting spores.

Moist heat is more efficient than dry heat as a means of sterilization and therefore streaming or "live" steam is an effective sterilizing agent. The steam is allowed to come in direct contact with the material to be sterilized, the most widely known apparatus being the Arnold Steam Sterilizer. Live steam at sea level has a temperature of 100 degrees Centigrade but in mountainous regions it may not reach this temperature. Under ordinary circumstances a single 15 minute exposure to streaming steam is sufficient to kill all forms of bacterial life. However, some resistant spores may remain alive after this treatment and proceed to germinate. Because of this, streaming steam used in the sterilization of food and dairy products may be applied at 15 minute periods on three successive days, thus insuring the killing of all spores. This is called *intermittent sterilization,* or *tyndallization,* named after Tyndall, a famous British biologist, who evolved the procedure of successive exposures.

Sterilization by steam under pressure, or Autoclaving, is similar in application to the pressure cooker in common household

use. This apparatus is called the autoclave, or digester. Its purpose is to subject its contents to steam under pressure, which has a higher temperature and therefore more sterilizing power than streaming steam. It consists essentially of a closed chamber into which steam under pressure can be introduced as the air is driven out. It is customary to sterilize fluids or free surfaces by applying a temperature of 115 to 125 degrees Centigrade, obtained at 15 to 20 pounds pressure for 20 minutes. This procedure is used in the commercial preparation of many canned foods such as corn, tomatoes, beans, etc.

Sterilization by hot air or dry heat should be used only for dry articles such as glassware, bandages, etc., as liquids or organic substances may be injured or decomposed by the high temperatures. The apparatus commonly used is a hot-air oven which can be maintained at a temperature of 150 to 170 degrees Centigrade for one hour. This temperature effectively kills all forms of life.

Along with the procedures of sterilization and disinfection there are several other measures employed to control the possible pathogenicity of animal or plant life. The following enumerates those most commonly encountered.

ANTISEPSIS

Antisepsis is the exclusion of putrefactive organisms and is a state produced by a chemical or physical agent known as an antiseptic. The term antiseptic in general is used to denote any substance that will inhibit the growth of organisms without necessarily destroying them. Oftentimes the term is used synonymously with germicide which is incorrect because a germicide has the power to destroy bacteria, not merely inhibit their growth. Of course a weak solution of a germicide may act as an antiseptic.

Some of the more common antiseptics in use today are iodoform, chloroform, hydrogen peroxide, potassium permanganate,

sulfonamid drugs and boric acid, along with silver nitrate, argyrol, thymol and eucalyptol.

PRESERVATIVE:

A preservative is a substance which may be added to foods in order to inhibit the growth of micro-organisms, so that fundamentally the terms antiseptic and preservative are the same. However the former is used in regards to disease-producing bacteria and the latter in reference to organisms present in food which may bring about putrefactive and other changes.

The common preservatives include benzoic acid, sodium benzoate, salicylic acid and sodium salicylate. Their concentration is usually 0.2% or less, but the Pure Food Laws of the United States forbids their use except for sodium benzoate which is allowed if the manufacturer labels his product with its presence and the amount.

ASEPSIS:

Means a condition free from germs or free from infection. It is a term most commonly employed in the field of surgery where it is spoken of as *aseptic surgery* in which every effort is made to prevent infection by the use of sterile apparatus, careful disinfection of skin, and rigid adherence to strict personal and environmental hygiene. Also in the bacteriology laboratory the worker endeavors to prevent contamination of his work by following an aseptic technic, such as the use of sterilized culture media and certain laboratory equipment.

BACTERICIDE:

A bactericide is any substance or agent which kills bacteria. It is synonymous with germicide. The suffix, -cide, indicates "killer."

DEODORANT:

A deodorant is a chemical which neutralizes, combines with, or absorbs odors of an offensive nature. It may have neither disinfectant nor antiseptic action and in some instances may cover up or mask infectious material rather than destroy it. Powdered charcoal is an effective deodorant.

INSECTICIDES:

Insecticides are agents used to exterminate insects. They are widely used in proprietary forms of liquids, powders and gases. Perhaps the most publicized insecticide is D.D.T. which enjoyed widespread usage in military preventive medicine.

PARASITICIDE:

Parasiticide is any agent, physical or chemical, which is destructive to parasites. The most common parasiticides are sulphurous acid, corrosive sublimate, acetic acid, sulphur, carbolic acid and mercurial ointment.

BACTERIOSTASIS:

Bacteriostasis is the rendering of bacteria inert or dormant without killing them. Their multiplication is prevented. Those conditions or substances which bring about the condition of bacteriostasis are called bacteriostatic. Cold and drying or desiccation are very effective agents in the preservation of food-stuffs and have a bacteriostatic action when applied for this purpose. Salt, vinegar, spices and sugar in concentrated solutions are often used for preservation of food because of their bacteriostatic properties. Certain drugs, among them sulfanilamide, and some of the aniline dyes, act to prevent the further growth of bacteria but do not necessarily kill the organisms.

CHAPTER XII

Parasitism

One of the most interesting of the associations between animals and plants is that of Parasitism. When one considers the term parasite in the broad sense, there is immediately brought to mind a picture of disease production, or pathogenicity. This may, or may not, be the case; because, hypothetically, a sharp line of distinction may be made between parasitism and pathogenicity. All parasites are not pathogenic as evinced in the state of *commensalism,* in which an organism is attached to the host and neither harms nor benefits it. For example, the spirochaetes found in the oral cavities of many persons are considered as commensals because they seem to serve no particular purpose, and yet are not destructive to the host.

Another relationship which may exist between the parasite and the host is that of *symbiosis* in which the two associated organisms are often mutually beneficial. This is illustrated very well in the bacterial flora of the human intestinal tract whereby the bacteria assist in the digestive processes and at the same time, gain their sustenance from this process.

Most actual parasites, however, do have a deleterious effect upon the body of the host; and this is usually expressed in a deranged physiology which is called dis-ease. For example, those protozoa which are actual parasites may injure the human body in three different ways. They may produce virulent toxins; they may destroy cellular structures; they may mechanically interfere with some of the physiological activities of the host. The best example of this is the action of the malarial parasite in man which destroys the erythrocytes, produces poisonous secretions, and interferes with the lymphatic and blood-vascular systems.

A parasite is an organism which is, at some time in its life cycle, dependent upon another organism, for its existence. The

literal meaning of the term is "eating at the table of another." Although the word parasite implies an organism belonging to the animal kingdom, parasites may be either animal or vegetable. Bacteria and fungi which feed upon the host are just as parasitic in their actions as are the unicellular animal protozoa. However, most parasites are low in the scale of life and are, for the most part, degenerate forms of animal or plant life, because they nourish themselves without exertion at the expense of the animal to which they are attached, thus voiding the use and development of certain organs and systems. In the strict sense, then, a parasite is an organism that lives upon, or within, the bodies of other living organisms. On the other hand, a Saprophyte is an organism which lives on dead organic matter, such as is seen in the conversion or decomposition of excreta and dead bodies of the higher forms of life into simpler compounds.

While certain organisms are actual or strict parasites and others are strict saprophytes, most of them enjoy the versatility that enables them to pursue either means of sustenance. Those that usually live on living matter but may live on dead matter, are called facultative saprophytes. Those that usually live on dead matter but may live on living matter are called facultative parasites.

CHIROPRACTIC AND PARASITISM

Immunity is defined as being the resistance to disease, and, as such, is a relative term. The factors of disease resistance are directly proportional to the degree of Intellectual Adaptation on the part of Innate Intelligence expressed through a normal complete cycle between brain and body. As long as the flow of mental impulses from brain cell to tissue cell is uninterrupted, all cellular structures will be in a state of adaptation capable of dealing with any invading force of a parasitic nature. If the body integument is physiologically normal and the mucosa or the various systems is the recipient of a normal nerve supply, then

we need not fear the presence of parasites capable of producing a group of symptoms collectively called dis-ease. Why may it be true that when two people eat from the same piece of uncooked pork at the same time and under similar circumstances, one may develop symptoms of Trichinosis and the other person suffers no ill effects whatever? Theoretically, both ingested the same amount of encysted Trichinella organisms of the same degree of virulency and yet the effect was entirely different. The answer seems to be that the intestinal tract of one was susceptible to parasitism, and that of the other was not. There can be only one reason for this—deranged activity or malfunction of the cells making up the intestinal tract. This lack of proper function and consequent loss of resistive powers, or immunity, or intellectual adaptation, is based solely and squarely upon a mental impulse supply lacking either the proper quantity or quality to maintain normal cellular function. What applies to a cell, applies also to a tissue, since a tissue is nothing more than a group of similar specialized cells joined together for a particular function. A tissue is no more resistant than the cells which comprise it.

On this basis, then, a cellular formation or tissue may lack the physiological activities necessary to deal with the parasite successfully, which, of course, would be the elimination of the parasite from the system. In the event that a state of parasitism has already been established in the human body, a restoration of normal mental impulse supply to the involved cells by the correction of a vertebral subluxation will bring about the eradication or destruction of the parasite. This end-result may be accomplished in various ways—by the secretion of substances capable of neutralizing toxins thrown off by the parasite, as seen by the successful elimination of toxic symptoms of malaria when a vertebral subluxation is corrected and normal mental impulse transmission is re-established; or by the secretion of substances inimical to the best interests of the parasite with its ultimate destruction and voidance, as seen in a case of intestinal worms

which are discharged, oftentimes en masse when the depleted tissue cells are brought back to normal function by restoration of 100% mental impulse supply.

The hygienic basis of resistance against infection by parasites is primarily that of avoiding the infective organism along with the time-worn and nondescript jargon of "a healthy mind in a healthy body." With this, Chiropractic fully agrees, but maintains that the ability or inability of a parasite to lodge within or upon the body of the host is dependent upon the power of Intellectual adaptation of that particular host and not upon the relative degree of virulency of the transgressing organism. In other words, the possibility for the establishment for a state of dis-ease comes from within, not from without, the human body.

PATHOGENIC PROTOZOA

The protozoa hold the same relative position in the animal kingdom as do the bacteria and fungi in regards to the plant classification—namely, they are single-celled animals in all phases of their existence. In some few cases, several cells may join together to form a colony. There are hundreds of species of known protozoa, but, of these, only a few are considered pathogenic to man. However, due to military operations during 1941 to 1945, in world zones where diseases associated with protozoa are pandemic, a great deal of discussion relative to these dis-eases has come to the fore. Malaria, trypanosomiasis, and leishmaniasis are but a few of the protozoan diseases which were, with the exception of malaria, comparatively rare in the United States until the outbreak of World War II.

For the most part, protozoa are beneficial to mankind as they are important in water and sewage purification and soil fertility. They are common in feces, soil, and pools of stagnant water. One species, *Entamoeba coli,* is considered a normal inhabitant of the human intestinal tract.

Most protozoa are so small as to be visible only through the use of the microscope. Like all living things they are composed of protoplasm, a complex organic colloid. Each protozoa, being a unicellular animal, has a nucleus which is essential to its continued existence and seems to serve at least three different functions, namely, growth, motion, and reproduction. In cells which have been bisected, that part retaining its nucleus may continue to live and recover from the injury; but, the portion left without a nucleus invariably dies. Even in so minute an animal as this, the functions of an Innate Intelligence are much in evidence. Undoubtedly, the nucleus serves as the seat of origin for impulses directly concerned with the vegetative functions of the cell, and once this has been cut off from its peripheral distribution, the organism ceases to exist as a functioning unit. The well-known property of irritability, or response to certain stimuli, by protozoa is further evidence of an intelligent force permeating the protoplasmic makeup. There is apparently an elementary nervous system in which the efferent flow from nucleus to periphery brings about motion, with an afferent flow conveying to the nucleus awareness of external stimuli. Interesting proof of this is provided by the experiment of placing a drop of heavy acid in water and observing the protozoon swim away from the vicinity of the acid, which, if touched, would be damaging to the cell membrane.

PROTOZOAN INFECTIONS

I. MALARIA

Malaria is found in all parts of the world which have tropical or temperate climates as in Panama, the South Pacific, and the Pontine marshes of Italy. It is considered as one of the most widespread of communicable diseases in spite of vigorous attempts to combat it. It is a disease of the red blood corpuscles associated with an ameboid parasite which undergoes an asexual

development cycle in human erythrocytes and a sexual cycle within the anopheles mosquito. The disease enlarges the spleen, brings about anemia, digestive and nervous upsets, and darkening of the skin. It is characterized by a pronounced febrile reaction.

Types of malaria. There are three characteristic types of malaria, each of which is associated with a particular species of the genus plasmodium.

Type A. *Tertian malaria,* associated with the *Plasmodium vivax.* This is the "ague" or most common type of malaria and is found in temperate climates. It is so-called because a person infected by it has a chill every third day and the fever is of the regular intermittent type. After a paroxysm, the patient rests comfortably until a new cycle is started in his blood stream by the plasmodium. The cycle is completed in forty-eight hours. This process of schizogony brings about a liberation of a considerable amount of toxin at regular intervals and this produces a paroxysm characterized by chills and fever.

Type B. *Quartan malaria,* associated with the *Plasmodium malaria.* This brings on a paroxysm every fourth day because it requires 72 hours to complete its cycle in the blood stream. Otherwise, its clinical manifestations are similar to those of the tertian type.

Type C. *Estivo-autumnal malaria,* associated with the *Plasmodium falciparum.* An irregular type with three stages in the paroxysm: during the chill, the patient feels cold; during the hot stage, he complains of warmth but his temperature is high in both stages; and in the sweating stage, the temperature drops, but usually at no time does he become afebrile. This is the most serious type of malaria.

Occasionally, a fourth type of malaria associated with *Plasmodium ovale* is mentioned. Clinically, it is very similar to *Plasmodium vivax,* although somewhat milder in its manifestations.

Method of transmission. Malaria is said to be transmitted to man only by the bite of a certain genus of mosquito called *Anopheles.* Only the female is capable of carrying the disease. The *Anopheles* may be differentiated from the common harmless *Culex* mosquito during the act of biting by the fact that her body is suspended almost vertically, whereas the *Culex* rests on the skin surface horizontally. When the mosquito bites, there is discharged from her salivary glands, a secretion containing the malarial protozoa. These enter the blood stream of the person bitten and start a complicated life history. At this stage, the injected organism is called a sporozoite. It soon attacks a red blood corpuscle and starts to develop inside the erythrocyte. It then divides to form many small spores or merozoites which escape from the red blood cells, each merozoite penetrating another red cell and beginning the development all over again. This process of maturation may be repeated several times and is called the asexual phase of plasmodium life. In order that this cycle be completed, it is necessary that merozoites enter the body of the Anopheles mosquito, which occurs when she sucks blood from an infected individual. In the intestine of the mosquito two kinds of cells are formed which are classed as male and female (similar to sperms and eggs). Fertilization takes place and the cell attaches itself to the stomach wall where it breaks up into *sporoblasts.* These develop into large numbers of delicate cells termed *sporozoites* which eventually pass into the body cavity of the mosquito and thence to the salivary glands from where they are innoculated into the human when the insect bites. This phase in the body of the mosquito is called the sexual phase, due to the male and female elements.

The period between ingestion of blood by a mosquito and the infectiveness of the bite is about twelve days at ordinary temperatures of 70° to 80° F.

Malarial control. Attempts at combatting malaria are directed either against the parasite or the transmitting agent. In the case

of a patient harboring the organism in his blood stream, quinine has been the standard remedy, although in recent years the widespread use of atabrine has been advocated. Malaria is also prevented by destroying the mosquitoes which transmit it; based upon the premise of making it impossible for them to breed. As the eggs are laid on water, and water is essential for the larval and pupal stages before adulthood is reached, the procedure is to drain or oil ponds or stock them with fish which destroy the larvae. Also, rough water is not a good breeding ground. The use of screens or nets to protect the population of areas where malaria is endemic is also widespread.

II. TRYPANOSOMIASIS

There are two main types of trypanosomiasis: African trypanosomiasis or African sleeping sickness and South American trypanosomiasis or Chagas' disease. Both diseases are associated with elongated spindle-shaped protozoa called Trypanosomes.

African Trypanosomiasis. This type occurs in two forms: Rhodesian trypanosomiasis associated with the Trypanosoma rhodesiense, and Gambian trypanosomiasis associated with the Trypanosoma gambiense. Some areas of Central Africa have been particularly involved in this form of sleeping sickness which is not to be confused with the Lethargic Encephalitis, or sleeping sickness found in this country and in other parts of the world, and which is assumed due to a filterable virus. Both Rhodesian and Gambian Trypanosomiasis are transmitted by a species of the tsetse fly. This fly bites an infected individual and the trypanosomes drawn up with the ingested blood undergo developmental stages in the bodies of the insects and finally invade the salivary glands of the fly, from which they are innoculated into persons bitten.

The disease process takes place in the blood plasma rather than in the cells as is true of malaria. The dis-ease is insidious in its progress and the first symptom is fever followed by pains

in the spinal region. The patient becomes pronouncedly listless and lethargic and finally settles into a comatose state which precedes the usual termination in death within a year after infection.

South American Trypanosomiasis is associated with the Trypanosoma cruzi which is also considered as being insect-borne although the exact means is not thoroughly understood. It differs from the African type in that the trypanosomes develop in the body tissues, particularly the lymphatics, instead of the blood plasma.

III. LEISHMANIASIS, DUMDUM FEVER, OR KALA-AZAR

This tropical disease, occurring for the most part in Asia, particularly India, is associated with the *Leishmania donovani,* a protozoon which is said to be transmitted by sand-fleas. For the most part, the disease is chronic and is characterized by emaciation, irregular fever, general progressive debility, and splenic enlargement. It may also produce skin lesions, particularly of the facial region, which become ulcerative and are sometimes called Delhi boils.

IV. AMEBIASIS

Amebiasis, or amebic dysentery, is an infection with *Endameba histolytica* which is a protozoon. The disease occurs most frequently in tropical or sub-tropical climates, but is occasionally found in the United States, Great Britain, and parts of Europe.

The endameba histolytica exists in two forms, either as vegetative amebas or as cysts. It is by these cysts that the disease is spread from person to person; they are surrounded by a resistent wall enabling them to withstand injurious agents destructive to the vegetative form.

When food contaminated with endameba cysts is swallowed, the cysts pass through the stomach and into the small intestine where their outside walls or shells are dissolved by the intestinal

juices and the vegetative forms are set free. These pass to the large intestine where they set up ulcerations, living upon blood and mucus cells around the ulcerated areas. A certain percentage are flushed from the intestine by diarrhea, others become encysted, thus upon elimination setting the stage for extended infection when another person contacts the cysts. Cyst formation does not take place outside the body.

The most important source of Amebiasis is the food-handler suffering from chronic amebic dysentery. Drinking water which has been contaminated with sewage is mentioned also. An epidemic of amebic dysentery has been traced to contaminated water. Uncooked foods contaminated with feces containing cysts and vegetables fertilized with human waste are given as other possible sources of infection.

Hygiene of amebiasis is dependent upon the exclusion of known cases from handling food, proper sewage disposal, and the general cleanliness and health of each individual.

V. TRICHOMONAS VAGINALIS

Trichomonas Vaginalis is associated with a severe and obstinate form of vaginitis in the female. The organism is a protozoon which is extremely motile due to a large whip-like process or flagellum found at one extremity or pole of the cell-body. The organisms are frequently found in many vaginal discharges from cases free of vaginitis.

In a vaginitis of the Trichomonas Vaginalis type, the patient relates a history of prolonged discharge which is strongly acid and produces an extensive irritation of the external genitalia, perineum, and surrounding areas. It may progress to purulency.

PATHOGENIC FUNGI

Fungi are placed in the lowest subkingdom of vegetable life and are characterized by the absence of chlorophyll, a substance

found in all other plant forms. Certain of the fungi are associated with superficial infections of the skin. The following are the most common diseases laid to fungus infection.

1. *Athlete's Foot* or Dermatophytosis, or ringworm of the foot, is the most common skin disease of the foot. It is associated with the fungus Epidermophyton, which thrives best in a moist, alkaline media at body temperature and is found in contaminated shoes, showers, swimming pools, and floors.

2. *Barber's Itch* or ringworm of the beard is considered the result of infection by the Trichophyton tonsurans. The means of transmission are by infected articles, such as towels, soap, shaving brushes, or by direct contact.

3. *Ringworm of the scalp* also is associated with Trichophyta, and is found most often in children. It is the most difficult form of ringworm to eradicate, being spread by direct contact or wearing apparel.

4. *Favus,* the common name for which is "crusted ringworm" or "honeycomb ringworm," is a contagious skin disease characterized by small yellowish crusts over the hair follicles and accompanied by itching and a musty odor. The fungus associated with Favus is called Achorion schoenleinii.

5. *Blastomycosis* is a suppurative inflammation characterized by the formation of multiple abscesses in the skin or viscera. Of the latter location, the lungs are most frequently involved. It is assumed that the disease is due to the budding of the fungus, Blastomyces, in the body tissues.

6. *Thrush* or *Parasitic Stomatitis* is an inflammation of the oral cavity and pharynx, characterized by milk-white elevations, which, on removal, leave a raw surface. The etiological organism is said to be a fungus, Sarcharomyces albicans, or Oidium albicans, or Monilia albicans. The disease is common in ill-nourished, breast-fed children, but it may be spread from person to person by contaminated fingers or utensils.

7. *Sprue* or *Psilosis* is a tropical disease found pandemic in the South Pacific and Asia. It runs a chronic course accompanied by wasting, loss of weight, anemia, diarrhea without tenesmus, erosion of the tongue, and falling of the hair. It is associated with the fungus, Monilia psilosis, which is said to flourish in the intestinal tracts of persons of poor dietary balance, particularly Caucasians living in the tropical regions of the Pacific.

8. *Madura Foot* occurs in tropical countries and occasionally, in the United States. It begins in the sole of the foot with a small, painless swelling which may rupture through the skin and discharge an oily, malodorous, purulent fluid through numerous sinuses. The foot becomes greatly swollen, but there is only slight pain present. The organism is called the Actinomyces madurae or "Ray-Fungus" due to its radial structure.

9. *Coccidioidal Granuloma* is a pulmonary disease resembling tuberculosis and blastomycosis of the lungs. It occurs chiefly in the San Joaquin Valley of California where it is called "valley fever" and is associated with a fungus called Coccidioides immitis, which has a wide distribution in nature.

MULTICELLULAR PARASITES OF MAN

TAPEWORM—TAENIA

There are two main types of tapeworms found living in the alimentary canal of man. These forms are parasitic in their action only in the adult stage of development.

Type 1. The Taenia solium is derived from pork and is commonly called the pork tapeworm. It reaches a length of from six to twelve feet.

Type 2. The Taenia saginata is derived from beef and reaches a length of twenty feet in some instances.

Both types are quite similar morphologically, differing mainly in their source.

Taenia is a long, flat worm with a large rounded head called the scolex, from which emanate suckers and hooks by which the parasite attaches itself to the intestinal wall. Behind the scolex is a short neck, followed by a series of segments which grow out from the neck region, thus making the caudal end of the worm the oldest portion. Each one of these segments, of which there may be as high as nine hundred, is called a proglottid.

Raw or improperly cooked flesh, from either a pig or cow which has been infested with a tapeworm, may contain the tapeworm larvae which become encysted in muscle tissues. Upon ingestion by the human, the cyst wall is digested and the larvae set free to develop into adult worms. Undeveloped eggs are discharged with the feces of the host, and may be numerous because most of the proglottids of the worm are concerned with sexual reproduction.

The main detrimental effect upon the host is a sustained irritation of the intestinal wall by the hooks and suckers of the parasite, and, to some extent, by the loss of nutritious material to the worm, which absorbs it through its body wall. The symptoms in the host are often absent completely, but if present, may manifest dyspepsia, loss of flesh, colic, and various nervous upsets such as "nightmares," palpitation, and restlessness.

Occasionally a third form of tapeworm is mentioned, the Taenia Nana or Hymenolepis Nana, a smaller form which averages about one inch in length. It is present in numbers in an infected alimentary canal.

HOOKWORM—NECATOR

There are two main types of hookworms which find their sustenance in the small intestine of Man.

Type 1. Ankylostoma duodenale, or Old World hookworm.

Type 2. Necator Americanus, or New World hookworm.

Both types are similar morphologically. The adult Necator Americanus is about a quarter inch in length and inhabits the

small intestine in great numbers. The mouth of the worm has many small hooks by which it attaches itself to the intestinal wall.

Hookworm disease is common in the Southern States. It is contracted by bare feet coming in contact with contaminated soil which contains the larvae of the worm. The larvae bore through the skin and enter the venous channels to ultimately reach the heart, from whence they pass via the pulmonary circulation to the lungs. From the lungs they pass up the bronchii and trachea to the esophagus which they descend to the stomach and intestine. Upon contacting the intestinal mucosa, the developing hookworms attach themselves and commence to secrete a poisonous substance which erodes the intestinal wall and small blood vessels. This poison is an anti-coagulant, so that the host suffers many small continuous hemorrhages. It is this blood that serves as nourishment for the hookworms. Since the larvae and the adult worms are passed from the host with the feces, the proper hygiene is to prevent possible soil pollution by proper disposal of human waste.

Infection with hookworm disease is called *Uncinariasis* and it is estimated that some two million people in the United States are afflicted by it. The victims of the disease are listless and lethargic. Oftentimes, pronounced symptoms of anemia are present and the case may present respiratory conditions due to the pulmonary involvement.

ELEPHANTIASIS OR FILARIASIS

Elephantiasis or Filariasis is a disease associated with a worm-like parasite, the Filaria bancrofti, or Wuchereria bancrofti. This is a blood parasite, approximately one one-hundredth of an inch long in the larval stage. During the daytime, they live in the deep arteries of the host and at night, they migrate to the cutaneous vessels where they may be sucked up by the bite of the Culex mosquito. They proceed to develop in the body of the mosquito until they are about one-twentieth of an inch

long, enter its salivary glands and are innoculated into the next person bitten. From the blood of the infected person they pass into the lymphatics of the lower extremities and scrotum, which channels they may obstruct to the point that a gross swelling takes place. The swelling is popularly called *Elephantiasis.*

The disease is essentially tropical and is found in the South Pacific, West Indies, South America, and parts of Africa. It was found in appreciable numbers among the negro population of Charleston, South Carolina. Such cases as the writer saw in Pago Pago, Samoa, seemed to be mostly unilaterally of the lower extremities. Sometimes the scrotum becomes engorged to the size of a large watermelon. The prognosis is poor and a return to normal size of an affected structure is rare.

PINWORM DISEASE

Pinworm, or Threadworm, or Seatworm disease is associated with the *Oxyuris vermicularis* or *Enterobius vermicularis,* a parasitic worm most often seen in young children. The adult worms pass from the large intestine and deposit their eggs around the anal orifice, producing an intense pruritis. The oxyuris vermicularis is a minute, threadlike parasite.

ROUNDWORM DISEASE

Roundworm disease has a world-wide distribution and is associated with the Ascaris lumbricoides, parasitic in the small intestine of man. Infection with the roundworm starts with the ingestion of food or water containing the eggs of the organism. The eggs pass to the small intestine and hatch out within a few hours after ingestion. The newly-hatched larvae burrow into the intestinal walls and pass into the venules, or the lymph capillaries. Most of them enter the portal system, pass through the liver, enter the right side of the heart and travel to the lungs

via the pulmonary artery. In the lungs they pierce the alveoli and enter the infundibuli from whence they pass upwards through the bronchial tree to the trachea and larynx, thence down through the pharynx and esophagus to the stomach and small intestines, site of their parasitism. The journey through the tissues of the host requires about ten days. Another two months is required for the larvae to reach maturity.

BOTHRIOCEPHALUS DISEASE

Diphyllobothrium Latum—also known as Bothriocephalus latum and Dibothriocephalus latum—is a species of tapeworm found in the intestines of man, and some animals such as dogs and cats. The head has two grooves along its sides and the worm may reach a length of 20 feet. It is about three-fourths of an inch in width. The organism seems to first infest certain mollusks eaten by fish. Upon eating infested fish, man in turn becomes infested. Fish most commonly involved are salmon, pike, perch, trout, and pickerel.

TRICHINOSIS OR TRICHINIASIS

Trichinosis is a dis-ease of human beings and pigs, associated with the parasitic worm known as *Trichinella spiralis.* The parasites enter the human body when uncooked or inadequately-cooked pork from an infected pig is eaten. At this time the organisms are encapsulated, but this capsule is soon dissolved in the stomach and the larvae are set free to mature in the small intestine. It is said that each mature worm deposits about 10,000 young. The young worms burrow through the intestinal wall and enter the blood and lymph vessels by which they are transmitted to the voluntary muscles and become encysted. These cysts may eventually undergo calcification. As many as 15,000 of these cysts have been counted in a single gram of muscle tissue. The most common site of encystment is in the diaphragm, intercostal muscles, and the sternocleidomastoideus.

The main symptoms of trichinosis are those of a gastro-intestinal upset, such as pain, nausea, emesis, and diarrhea. There may be also a localized myositis, due to the muscular involvement, along with an elevation of temperature and profuse sweating. In severe cases, prostration may be marked.

Hygienic control is dependent upon several possible courses; first, is rigid meat inspection control; second, discontinuance of the feeding of uncooked pork to swine as in garbage; third, cooking pork well, at a temperature of at least 140 degrees F; and finally, by keeping pork under proper refrigeration, because a temperature of 5 degrees for 3 weeks will kill the larvae in the pork.

ECHINOCOCCUS DISEASE

Echinococcus disease is similar to infestation with Taenia saginata or the beef-tapeworm. It is associated with the *Echinococcus granulosus* which lives in the adult stage as a parasite in the intestines of the dog, and gives rise to larvae known as *hydatids*. These hydatids, upon entering the human body, may form a large vesicular cyst in the tissues or organs, called a *hydatid cyst,* which may rupture with fatal results. The Echinococcus has a world-wide distribution; particularly in Argentina and Australia is it prevalent, and is usually transmitted by infected and improperly cooked meat from beef and hogs.

SCABIES—THE ITCH

Scabies is a contagious disease, associated with the *Sarcoptes scabiei* or *Acarus scabiei* or *Itch-mite,* which burrows beneath the skin and causes intense itching. The condition is characterized by a vesicular or pustular eruption connected to a burrow (cuniculus) which is usually visible to the naked eye. The most common areas affected are the hands between the fingers, the wrists, axillary space, groin, and chest. The scalp and face are rarely involved.

The Itch is said to be transmitted by contact with infested articles, such as clothing, bedding, etc. It is common among prostitutes and is transmissible through sexual contact.

CHIGGER BITES

Chigger bites are due to the *Lepus Americanus,* or Chigger, or Harvest-tick, which gets under the skin and causes a dermatitis. They are transferred from plants to the human by direct contact and seem to locate mainly in the ankles and legs.

CHAPTER XIII

The Rickettsiae Organisms

This particular group of bacteria was named after H. T. Ricketts who first related one of them to Rocky Mountain Spotted Fever. They seem to be associated with five diseases in human beings and their most well known vectors include certain arthropods such as lice and ticks. Publicity accorded these diseases in public health circles warrants special consideration of their more salient features.

The Rickettsiae are described as being small rod shaped bodies. For a detailed account of their morphology and cultural habits the student is referred to an advanced text in bacteriology. We are more concerned here with their pathogenicity and mode of transmission. They have been associated with the following diseases of man.

1. *Typhus fever,* also called jail fever and camp fever. An acute contagious disease associated with unsanitary conditions, overcrowding and poverty, it seems to be most prevalent in the colder months of the year. The disease is manifested by severe prostration, nervous symptoms and a high fever. A petechial rash may be present. The organism blamed for the disease is called *Rickettsia prowazeki* and is said to be transmitted by the body-louse.

The main procedure for the control and elimination of typhus fever is preventive. Absolute cleanliness, sterilization of the clothing and similar measures are employed. During the late war the use of delousing camps or areas was a common preventive procedure. All patients should be isolated.

2. *Trench Fever.* A common disease among troops of the First World War. It was not frequently fatal, but the morbidity rate was high. High temperature and polyuria were distressing

symptoms. This disease has been associated with the *Rickettsia quintana* and is said to be transmitted by way of the body-louse. Good hygiene and sanitation measures are the best means of control.

3. *Rocky Mountain Spotted Fever.* A disease more or less endemic to the Far Western United States, closely resembling typhus fever in its clinical manifestations. The causal organism is named the *Rickettsia rickettsi* or *Dermacentroxenus rickettsi* which is transmitted by way of the wood tick. In some of the Eastern states the dogtick is blamed for its transmission.

4. *Tsutsugamushi Fever* or Japanese River Fever, is very similar clinically to Rocky Mountain Spotted Fever and is said to be transmitted by a tick also. The organism is called *Rickettsia nipponica.*

5. *"Q" Fever,* was first described in Australia but now is common in the Mediterranean area. It is similar to pneumonia and the Balkan Grippe. The disease strikes suddenly with the symptoms of headache, sweats, chills and shooting pains in the muscles. It is associated with a type of Rickettsia and is supposedly transmitted through inhaled dust containing the organism.

CHAPTER XIV

Virus Diseases

Filtrable or ultramicroscopic viruses are disease agents that as yet have been invisible under ordinary methods of microscopy although the advent of the electronic microscope is said to offer interesting possibilities in this field. They are described as filtrable because they are able to pass through any filter which will retain all ordinary bacteria. As yet they have not been grown successfully on laboratory media although attempts are being made to use the membranes of chick embryos. The best method of growing the viruses is by inoculating susceptible laboratory animals.

Viruses are held responsible for many diseases of plants and animals as well as some of the most virulent infections in man, although peculiarly, such diseases are followed by a very strong and lengthy immunity to subsequent attacks. The following diseases are those most commonly associated with filtrable viruses:

SMALL POX

For centuries small pox has been considered one of the great scourges of man because of its prevalency and its disfiguring effect upon victims. Small pox is said to be transmitted by direct contact, or by fomites, entering the body via the respiratory tract. Considered highly contagious, it is recommended by health departments that all cases of small pox be isolated, and all objects coming in contact with the patient be sterilized. A case should not be released from quarantine until complete desquamation has taken place.

Small pox probably has enjoyed the widest publicity of any disease as far as the question of vaccination is concerned. Jenner

was the originator of the vaccination theory which today has almost universal support, particularly in regard to smallpox. However, only 14 states, at this writing, have laws making small pox vaccination compulsory. Such vaccination as it is performed today, consists of inoculation of an individual with the putrified material obtained from the skin lesions of calves infected with cowpox, considered as being the same as human small pox.

Advocates of vaccination claim that a lifelong immunity may be acquired because it is well known that a person rarely has a second attack of variola.

RABIES

Rabies is also known as hydrophobia. It is an acute, paralytic, infectious disease primarily associated with man. Dogs are named as the propagators of the disease, although cats, horses and sheep are also considered.

The disease produces two different clinical manifestations: (1) the furious type, evinced by great excitability and paralysis, terminating fatally, and (2) the dumb type, in which quiescent paralysis and death is the rule.

Animals suspected of having rabies are imprisoned under observation for ten days. If rabitic proof is found they are killed, and the head and spinal cord examined by staining with Negri stain. In the nervous tissue of dogs having rabies there are found small oval-shaped bodies called Negri bodies which lie in the nerve cells close to the nucleus. The virus is said to be inoculated into the human by way of the dog's saliva when he bites; hence the dog is considered as the main reservoir of the disease.

The incubation period in man varies from 20 to 55 days with 40 days considered the average.

The recommended procedure in a case suspected of having been bitten by a rabid dog or other animal, is to start the use of antirabic vaccine immediately after the bite and continue such therapy until after ten-day observation has either proved

or disproved the presence of rabies in the dog. If rabies is absent the treatment may be discontinued. The antirabic vaccine procedure is called the Pasteur treatment. From the standpoint of public health it has been suggested that more rigid enforcement of licensing and muzzling laws be carried out in order to prevent rabies.

MEASLES

Measles is another so-called virus disease. It is a very common childhood disease and is considered highly communicable. The etiological factor is said to be found in the secretions of the eye and the respiratory tract of the infected case. However, it does not seem to be highly communicable after the fever has subsided. It is considered as being highly transmissible among crowds of young adults and may be epidemic in army camps, schools, etc.

Prophylaxis of measles is based upon the injection of blood serum from convalescent cases of the disease, although to date the results are very undecided.

INFANTILE PARALYSIS (POLIOMYELITIS)

A virus is considered as the etiological factor in infantile paralysis, probably the most publicized disease of our age. It is an acute infectious disease of the central nervous system, which, however, is not confined to infants, nor always accompanied by paralysis. It is not considered highly contagious and an attack confers a lasting immunity. Epidemics seem to occur during the summer months of July and August.

Convalescent serum taken from individuals recovering from an attack is used as a prophylactic in exposed individuals, but it has failed completely as a therapeutic measure. The greatest contribution to the medical treatment of infantile paralysis was made by an Australian nurse, Sister Kenny, originator of the famed "Kenny Treatment."

MUMPS (EPIDEMIC PAROTITIS)

Mumps is also named as being a virus disease. It occurs most frequently between the 5th and 15th years of life. It is said to be highly contagious and the mode of transmission is direct contact by way of the saliva. Local treatment is used to care for such cases.

YELLOW FEVER

Yellow fever is a disease found in the tropics of America and Africa. It is associated with filtrable virus, transferred from one human to another by the bite of a specific mosquito called Stegomyia fasciata (Aedes aegypti).

The accepted measure of control of the disease is based upon eradication of the mosquitoes which transmit the disease. Vaccines have been prepared with rather varied results.

LYMPHOGRANULOMA INGUINALE

A venereal disease sometimes called climatic bubo and associated with a virus. Very little is known about the disease as yet but it forms the basis for the well known Frei Test which consists of the injection into the skin of purulent material of active cases. A bright red spot appearing at the site of the injection is a positive test.

OTHER VIRUS DISEASES

Other diseases associated with filterable viruses include Chicken-pox, Dengue Fever, Parrot Fever, Herpes Zoster and Foot and Mouth Disease.

CHAPTER XV

Lighting

Throughout the thousands of years in the evolution of man, he has been essentially a creature whose natural habitat was the out-of-doors, and much of his activities were performed in daylight. His visual apparatus was developed to function under the illumination of sunlight, or daylight, and when darkness came he slept. It has been only in the past hundred years that man has installed much of his work indoors, away from sunlight. During this period, his work has become increasingly fine and delicate in many phases. His eyes adapted through the centuries to daylight, must now adapt to the lighting condition of office, factory, school, and home. In four great fundamentals of vision man and nature are at odds; these may be enumerated graphically as follows:

Natural vision

1. Abundant outdoor light.
2. Distant vision—20 feet or more.
3. Intermittent use of the eyes.
4. A day ending at sunset.

Man-made vision

1. Insufficient indoor light.
2. Near vision—10 to 30 inches.
3. Continuous, prolonged use of the eyes.
4. A day prolonged for work.

The one controllable factor, which if properly instituted may be of hygienic value to the eye, is light. Light is the sensation produced by the electromagnetic radiation which falls on the retina. Basically, there are two main types of light: natural and artificial.

Natural light. In order for man to see the tasks he performs indoors it is necessary that provision be made for the admittance of natural light, that is, light which emanates from the sun's rays. All light, natural or artificial, is measured by foot-candles, which are called a light unit. A foot candle is the amount of light measured one foot from a standard candle. A scientific apparatus called a light meter is used to accurately measure the amount of light present at a given time and place. Nature is very generous in the amount of light she bestows upon the outdoors during daylight. For example, at high noon on a clear day the light intensity is 10,000 foot-candles; under a tree there are 1,000 foot-candles, and even on a cloudy, rainy day the illumination is several hundred foot candles. Unfortunately, this powerful lighting is not readily transmissible into our homes and offices. There is much loss of light value when it passes through glass or other substances, or when reflected indoors from outside. Loss of foot-candles is great even in a modern home with many large windows to each room. It has been demonstrated that when the sun is shining brightly at noontime with 10,000 foot-candles, the illumination is only about 100 foot-candles at the window sill of a house and only ten feet from the window, the foot-candle power has dropped to about 20. When light passes through plate glass, there is a loss of about 8% and when passing through frosted glass, the loss may run as high as 50%.

For good visual hygiene, the natural lighting of the home should be admitted by a window area at least 10% that of the floor area, or approximately one square foot of clear glass surface for every 70 cubic feet of space in a room. In the case of school rooms or factories, it is recommended that the window area be at least 25% of the floor area.

Artificial lighting. It is accomplished by the use of light that man makes when the direct natural method is unavailable or insufficient. Modern scientific lighting, if properly used, may

be a satisfactory substitute for natural light with its high illuminating power. In his quest for proper artificial light, man has burned various and sundry substances, all of which proved unsatisfactory from one or more standpoints, until the discovery of the electric light by Thomas A. Edison in 1879. Light from candles, wood fires, oil, kerosene, and illuminating gas all fell by the wayside as a means of artificial illumination when the incandescent lamp was brought forth, because it gave out light of the desired intensity, with no vitiation of the air, and was economically inexpensive. The other means of illumination were objectionable in that they gave off carbon dioxide and other impurities, the light was flickering and uneven, and they required constant attention.

SYSTEMS OF ARTIFICIAL LIGHTING

There are three systems of artificial lighting in common use: direct, indirect, and semi-indirect lighting.

Direct lighting is secured by fixtures which throw the light downward into the room, such as from a bridge lamp, or a suspended light bulb covered with a shade. This is an efficient means of lighting, but has the drawback of glare. Glaring lights are hazardous to eyesight as well as being wasteful in that they reduce visibility. When too bright light attempts to enter the eye there is an automatic contraction of the eye pupil. Thus from 40 to 80 percent of useful light is wasted in counteracting the effect of glare. A reflected glare, which is glare from shiny surfaces such as glass-topped desks, store counters, printed pages, etc., may interfere with vision even more seriously than direct glare.

Indirect lighting is accomplished by placing an opaque, bowl-like fixture around the bulb, reflecting the light rays upwards towards the ceiling from whence the light is diffused throughout the room. Its advantage lies in the absence of glare, but it must be of sufficient intensity to insure proper illumination for read-

ing and other purposes. This type of lighting is more expensive to operate because of the need for more light; otherwise if inadequate power is used, it will produce eyestrain by giving insufficient contrast or insufficient brightness to the object being seen, whether it be print, or faces, or other work.

Semi-indirect lighting is in widespread use today and seems to be most satisfactory of the three systems. It employs a semi-opaque bowl around the light bulb, which the rays of light are able to pass through with sufficient intensity to produce abundant light, evenly distributed and without objectionable glare and shadows.

HYGIENE AND LIGHTING

Good lighting is good hygiene because it is not only a question of saving eyesight, but physiologically, of conserving human energy also. For example, research has shown that glaring or inadequate lighting has the effect upon eye muscles of producing greater contraction of the pupil with continuous contraction of the ciliary muscle for accommodation, as well as requiring greater effort for muscular convergence. When this brings about an expenditure of muscular energy after a fatigue level has been reached, the result is headaches, dizziness, digestive disturbances, and blurring of the vision. When reading under a good light of 100 foot-candles, the nervous tension averages only about two-thirds as much as under one foot-candle.

The eyes should have carefully designed artificial lighting, adequate for all periods in the life of the individual. In the childhood period, the eyes are undergoing formative habits and may be injured by light of improper quantity or quality. As the eyes grow older, certain physiological changes occur which decrease visual acuity; for example, the eyes of a 50-year-old person admit only one-half the amount of light as those of a 20-year-old.

VISUAL DEFECTS

There are two important factors which influence the eyesight of our population in the United States today, namely, age and occupation. Statistics show that 23% of all people under 20 years of age have defective vision, between the ages of 30 to 40 about 48%, and after 60 years about 95% of the people have poor vision. From an occupational standpoint, the farmer and the laborer are afflicted with less than 20% of visual disorders, the carpenter and painter with less than 40%, the scholar with 60 to 80%, and the stenographer and draftsman with 80 to 100% of all cases of ocular disease, or eyestrain. In the case of students, it has been found that 24% of all high school students and 31% of all college students are nearsighted, which shows the gradual increase of this eye condition through the years of scholastic concentration, as compared with only 7% of children of pre-school age.

These figures point out the improper visual hygiene of the average person; they show the neglect and misuse of eyes which could enjoy a higher efficiency of sight over a longer period of time. Vision is based upon three elements—the light, the eye, and the task. Only the light is a controllable factor and if hygienically and judiciously used, it will do much to lessen eyestrain and subsequent failure of visual acuity.

THE PRESERVATION OF EYESIGHT

The logical point at which to start an intelligent campaign of training to preserve and care for the eyes is in the school years of the child. Habits of good hygiene are not easily forgotten and may be maintained throughout life, if properly learned in the early years. The following suggestions might be used in outlining the proper care of the eyes both for school child or adult.

1. Do not work in a flickering, unsteady light.
2. Do not expose the eyes to an unshaded light.
3. Do not read or study in a reclining position, or in a moving vehicle.

4. Read only in a light properly suited to the task; scientific data on the light for the task is readily available at any electric store or power company.

5. Do not face the light. When reading or writing, it is best to have the light coming over the left shoulder to avoid the casting of shadows upon the object at hand.

6. Keep bulbs and globes clean.

7. Use light wall paper or paint, as dark walls absorb light instead of reflecting it. The use of a very dark paper or wall finish may require three or four times more light than is necessary. Browns, greens, and reds reflect only about 10% of the light rays; whereas, white, cream, and light yellow may reflect as high as fifty percent of the light. Of course, if the light is meant for local use only, there may be no particular disadvantage in having the rest of the room only slightly illuminated.

In addition to these rules, the school-child's eyes may be protected in the following ways in order that his vision be under a minimum of strain.

8. The window shades should be light colored and translucent, and should be drawn when the light of the sun shines on the pupils, boards, or desks, in such a way as to produce a glare, or when a glare is reflected from snow, glass, or an adjacent building.

9. The desks and other woodwork in the classrooms should have a dull finish, rather than one highly glistening which causes bad glares and reflections.

10. The blackboards should be black; not streaked, cracked, dim, or dusty. They absorb a great amount of light and therefore should be as small as possible. They should be so placed that the light falls upon them from the left rear when the pupils are facing them, and they should never be placed between two windows.

Children complaining of the following symptoms should be

suspected of having defective vision and prompt measures should be taken to check the eyes:

1. Complains of frontal headaches and eye fatigue upon reading.
2. Squints, even if only occasionally.
3. Says that the letters being read run into one another.
4. Holds a book closer than twelve inches from the eyes when reading.
5. Fails to keep the lines when reading.
6. Habitually leaves out words when reading.
7. When seated in the back row, cannot see what is written on the blackboard.

WARNINGS OF DEFECTIVE VISION

Eye diseases, lack of needed glasses, or improperly fitted glasses may cause many symptoms, chief among them being eyeaches, headaches, eye fatigue, inflammation or soreness of the lids, watering of the eyes, and swelling, drooping and puffing of the eyelids.

CHAPTER XVI

Light Therapy

The importance of sunlight to all forms of life is well known. Without its beneficial rays, there could be no life as we know it today. Both animal and plant life depend upon its life-sustaining force to carry on metabolic processes normally and completely. Seemingly, bacteria and other low forms of living matter are the only creatures which cannot utilize its properties. It provides light and heat for the earth, as well as being nature's greatest germicidal agent. Its therapeutic value in certain physical and mental ailments of man is well known. It is a psychological factor of great stimulus!

Man has artificially produced lights which simulate sunlight, as well as other forms of light waves to help him heal diseases and produce certain artificial body states. We, as chiropractors, are cognizant of the potential value of these procedures when a temporary effect is desired in treating human ailments. But, we do not condone their use by a chiropractor because such therapy is outside the proper scope of chiropractic practice. Light therapy does not remove the interference with the transmission of mental impulses resulting from a vertebral subluxation. It is not an adjustment of the spinal column for the purpose of restoring normal nerve supply to tissue cells. It is not a correction of *cause,* which is the basis of chiropractic, but a treatment of *effect.* Chiropractors believe that those who would use this apparatus should attend a regular course, as given by certain large universities in the United States, qualifying for a Certificate of Proficiency for Technicians in Physical Therapy and set themselves up in practice as physical therapists—not chiropractors.

This brief consideration of light therapy is included for the purpose of acquainting the student with some of the principles

behind this phase of the healing art. Light therapy is merely a form of physical therapy, which includes the utilization of such natural agents as sunshine, water, massage, exercises, mechanical forces, and electricity in the treatment of disease and injury.

Sunlight is made up of several visible colors, and some which are not visible to the human eye. Those visible are red, orange, yellow, green, blue, indigo, and violet. All colors have a wave vibration rate which is definite for each color, and these waves are measured in Angstrom units or the units of wavelength. An Angstrom unit is one one-tenth of a millimicron or one two hundred and fifty-four millionths of an inch.

Violet is the first color seen in the spectrum, and is located from 4,000 to 4,500 on the Angstrom unit scale. Red is the last color and ranges from 6,900 to 7,700 Angstrom units. The other colors range between these two figures.

ULTRA-VIOLET LIGHT

Ultra-violet light is beyond the visible range of the spectrum and is between the violet rays and the roentgen rays; these rays have wave-lengths between 200 and 4,000 Angstrom units. It is invisible to the human eye, gives off no heat, and has powerful chemical properties when acting upon the body. These rays are soluble in blood and are absorbed in the capillaries after passing through the layers of the skin. It is generated in two forms—far ultra-violet, which is farthest from the violet; and near ultra-violet, which is nearest to the visible violet.

The near, or short rays are used for infections such as pyorrhea, boils, eczema, psoriasis, various forms of dermatitis, and ring worm. These short rays are said to kill bacteria, are readily soluble in protoplasm, and stimulate the production of white blood corpuscles.

The long, or far, rays increase the number of erythrocytes and so are used in anemia. Also, they have an action upon the min-

erals of the body, particularly calcium, and are used to treat rickets and tuberculosis.

The percentage of ultra-violet rays in sunlight is extremely small and variable, due to interference from smoke, dust, moisture, altitude, and geographical location. Because of this fact, it is pointed out that ultra-violet lamps provide a constant and measured amount of light rays, free of variables.

INFRA-RED RAYS

Infra-red rays are found at the opposite end of the color spectrum from ultra-violet rays, and they too, are invisible. However, they produce heat and are capable of deep penetration. They are generated through a carbon medium and are widely used to allay deep congestion and pain. Their wave-lengths run from 7,700 to 500,000 Angstrom units. Their main sources are sunlight, electric arc, incandescent lamp, and infra-red lamp.

Infra-red lamp therapy is used in neuritis, rheumatism, sprains, bruises, burns, asthma, dysmenorrhea, nephritis, and lumbago.

Its use is contraindicated in conditions of confined pus, acute pulmonary tuberculosis, and whenever hemorrhage is possible from hyperemic states.

DEEP THERAPY LAMPS

The popular term for the deep therapy lamp is the "sunlight lamp" which produces rays within the visible spectrum of the sun. It throws off much heat which acts upon the superficial layers of the skin to produce a vasodilation and subsequent increase of blood in the skin capillaries. Its most extensive use is in the treatment of nervous disorders because of its soothing effect. Stiff and sore muscles are also benefited by the application of deep therapy.

CHAPTER XVII

Air and Its Relation to Hygiene

Air is the one part of man's environment which is always in direct contact with him and is absolutely indispensable for the continuation of his life processes. It flows over the entire external body surface as well as entering the lungs where some 90 square meters of tissue are bathed by it. The tissue cells and organs are dependent upon its presence for their normal physiology of internal respiration and the blood stream devotes much of its capacity to the carrying of air to these tissue cells. It is no small wonder, then, that the health and general welfare of the human is so totally dependent upon the atmosphere and its content of gases necessary for expression of life.

CHEMICAL COMPOSITION OF AIR

Chemically, air is a gaseous mixture which is subject to slight variations but it contains approximately 21% Oxygen, 78% Nitrogen, 0.9% Argon, and traces of gases such as ozone, carbon dioxide, ammonia, and others. Various estimates place this blanket of air around the earth as being approximately one hundred miles in depth. This layer is technically referred to as the atmosphere. The various gaseous components of the atmosphere are sufficiently important in themselves to warrant a brief consideration of their more outstanding characteristics, particularly in regard to their relationship to the human body.

a. *Oxygen* is a tasteless, odorless, colorless gas with an atomic weight of 16. It is essential to life and is the most important and abundant chemical element yet discovered. It is the only element that enters the animal body in the free state and it constitutes by weight three-fourths of the animal, four-fifths of the vegetable, and one-half of the mineral kingdoms. By volume, it forms

one-fifth of the atmosphere, and eight-ninths by weight of water. It helps maintain the oxygen-carbon-dioxide balance of the atmosphere by being absorbed into plants in the form of water and carbon-dioxide, and is converted by them into organic foodstuffs for man; and then is returned to the atmosphere by man in the form of wastes such as water and carbon-dioxide. Since oxygen represents 20% of the elements in arterial blood and 12% in venous blood, it is important to know the effects produced by any departure from the normal percentage of oxygen in the air being breathed.

Variations in the oxygen percentage:

100%—no harmful effect, if only temporarily breathed.
70%—may be inhaled indefinitely with no harm.
17%—will extinguish a candle.
14%—causes slight cyanosis and increased respiration—it is the beginning of respiratory distress.
10%—is dangerous, and may produce sudden unconsciousness.
7%—or less, will cause death.

The average male adult inhales approximately 34 pounds of air each twenty-four hours, and of this, about 20%, or 7 pounds is oxygen. However, only 25% of the total amount of oxygen entering the lungs is utilized by the body cells so that the total weight of oxygen used per 24 hours is about 2 pounds.

b. *Nitrogen* is also an odorless, tasteless, colorless gas with an atomic weight of 14. It serves to dilute the oxygen of the air, but under ordinary atmospheric pressures, it is inert as regards human respiration. It flows into and out of the lungs unchanged either in amount or chemical properties. Nitrogen forms almost four-fifths of the total volume of the atmosphere. It is an essential part of all proteins and is generally found in organic matter as compounds, such as ammonia, nitrates, and nitrites, which are converted by plant life into proteins. Consumed by man, these proteins are converted into animal proteins in the tissues and the

blood, and are discharged from the human body in the form of creatin, ammonia, and urea.

c. *Carbon-dioxide,* also called carbonic acid gas, is a colorless, pungent, acid-tasting gas, which is heavier than air and thus may attain a concentration of .03% of the atmosphere close to the ground. It represents the final product of the combustion of carbon in food, which the human body exhales through the lungs, eliminates in the urine, or perspires through the skin. It is essential to all plant life and is absorbed directly from the air by them; to plants it occupies the same importance as does oxygen to animals. It has been estimated that some 500,000,000 tons of carbon dioxide are passed into the air each year from combustion, decomposition, and fermentation; but, as it is used by green plants, the concentration is kept to about .03% in air. A slight variation from this figure will have detrimental effects upon animal and vegetable organisms. Its effect upon human has been given as follows:

Variations in the carbon dioxide percentage:

30% or more produces loss of consciousness leading to death.

6% produces distressful breathing with severe headaches.

5% produces marked increase in breathing, even at rest.

3% is noticeable only upon muscular exertion.

Carbon dioxide is a valuable respiratory stimulant and as such has found wide-spread use as a mixture with pure oxygen to resuscitate the victim of asphyxiation, as in coal gas poisoning, or drowning. A mixture of 93% oxygen and 7% carbon dioxide is compressed into steel cylinders and used when the need arises. This apparatus is called a pulmotor.

d. *Ozone* is a form of oxygen in which three atoms of the element unite to form the molecule O_3. It gives an odor similar to chlorine when mixed with air and is found only in traces in the atmosphere. Its most important sources are heavily forested areas and sea air, although it is formed when oxygen is exposed to the discharge of electricity, such as during lightning storms.

Being a more active form of oxygen with a resultant influence upon respiration, it may explain the invigorating effect of air found near forests or out at sea, and is a minor reason for people seeking out these places in the interest of their health.

e. *Argon* is an inert gas as far as respiration is concerned even though it makes up about .94% of the atmosphere. It exerts no hygienic influence upon the body, either good or bad. Along with it are found other members of the argon group, such as neon, xenon, helium, and krypton, which are referred to chemically as "inert gases" because they will not unite with other elements to form compounds.

f. *Ammonia* is found in the air only in traces and is a gas formed by the decomposition of nitrogen-containing substances. It helps make up many poisonous substances, such as the amines, but it is also necessary to proteins and other useful chemicals.

g. *Miscellaneous* air may also contain negligible amounts of carbon monoxide, hydrogen peroxide, and aqueous vapors. The air of industrial areas is often polluted with smoke and other fumes, and at times the amount of dust and bacteria in certain areas may be very heavy.

FUNCTION OF AIR

From a physiological standpoint, air has two primary functions. The oxygen content is essential to metabolism in the human body, and the movement of air around the body is necessary for the disposal of certain metabolic waste products such as heat, carbon dioxide, and water vapor. On this basis then, beneficial air must be of such a chemical composition and movement as to best serve the interests of the human body; and failing in this, it may be considered as physiologically unsuited to the proper functioning and hygiene of the body.

If deficient in oxygen, or without movement, the air of occupied enclosed places becomes vitiated with the production of

certain physiological reactions. This impure air not only induces lassitude, debility, and flushing of the skin, but may have other far-reaching effects.

For many years physiologists were of the opinion that impure air acted detrimentally upon the human because of the chemical changes which take place in air breathed over and over without being replenished. They assumed that rebreathing of the same air would so reduce the total amount of available oxygen, that asphyxiation would result. This is true after a certain point has been reached, but further experimentation showed that the human body began to react long before the oxygen content was at a dangerous level. Coincident with the reduction of oxygen, there is an increase in the amount of carbon dioxide which also has a detrimental effect when present in excessive amounts. However, the possibility of air in an unventilated place reaching a sufficient concentration of carbon dioxide as to produce any appreciable harm, has been found to be remote. Also mentioned in respect to chemical contamination of air is the possible discharge of toxic organic wastes from the exhaled air and that these poisons are a cause of the symptoms which arise when impure air is breathed consistently. Today all three chemical factors—decreased oxygen, increased carbon dioxide, and unknown organic poisons—are considered as only minor factors in air contamination.

The physical qualities of air have now superseded chemical qualities as the principal essentials of healthful, comfortable living and working conditions. The cooling properties of the atmosphere have become more important as regards health, than have the properties of oxidation or carbon-dioxide concentration. This has been proven in many different tests but perhaps none better illustrative of the point than the experiment carried out by the noted physiologist, Flugge, who installed a human in a closed chamber for over four hours. During this time, the temperature rose to 75 degrees Fahrenheit, the humidity to 89%, and the

carbon dioxide to 1.2%, and the patient suffered the usual drowsiness, weakness, and malaise of poor ventilation; yet, patients on the outside breathed the same air through a system of respirators and they suffered no ill-effects whatever. The temperature of the chamber then was reduced by cooling coils with the chemical content of the contained air unchanged. Immediately the patient began to get relief from the cooling effect. In other words, the evil effects of impure air upon the human body are due primarily to a physical and cutaneous phenomenon rather than a chemical and respiratory one. Under ordinary living conditions, air lacking in proper temperature, humidity, and motion, has a much more harmful action on the human organism than air lacking in oxygen, or having too much carbon dioxide.

VENTILATION

Ventilation may be considered physiologically or physically. In physiology, we consider ventilation to be the amount of air inhaled each twenty-four hours. This figure can be approximated by multiplying the number of respirations per day by the amount of tidal air breathed in by the average individual. The average figure given is about 10,000 cubic centimeters, and on this basis, hygienists recommend that a minimum of 2,000 cubic feet of fresh air per hour be available to maintain healthful respiration.

Ordinary ventilation or physical ventilation is the process or act of supplying a house or a room with fresh air sufficient for the healthful needs of the human body. This may be accomplished by natural or mechanical means.

Natural ventilation is a system of ventilation accomplished by the flow of air through open doors and windows or through cracks in the construction of a building. Now that many homes are being constructed with the joints fitting more closely together, and with weather stripping and insulation in general use,

the flow of air through structural deficiencies may be at a minimum. In an ordinary home, air leakage around a window frame is such that a 20 mile an hour wind will force enough air into an average-sized room to completely change the air every hour. Home builders concerned with heating efficiency endeavor to prevent such heat loss by fitting windows more securely, thus reducing the amount of fresh air entering a room by natural methods.

An open window may provide suitable ventilation, provided air does not enter at a speed high enough to form a draft—a draft being defined as air circulating in excess of four miles per hour. It is especially important that the ventilation of a sick-room be free from drafts. This is best accomplished by placing a three-inch wooden strip under the lower sash, permitting enough air to enter the room between the lower part of the upper sash and the upper part of the lower sash. Several patented devices are available which allow draftless ventilation through windows.

The natural system of ventilation depends for movement of air upon wind, the diffusion of gases, and differences of temperature. With no wind blowing, and the inside temperature of room the same as the outside air, ventilation would be at a minimum. This system is dependent also upon the size and type of building, number of occupants, necessity for artificial heating, and other factors, such as the purity of the air obtainable, whether or not polluted with smoke, dust, fumes, etc.

Artificial or mechanical ventilation is effected by the use of apparatus which displaces vitiated air and replaces it with fresh air by such mechanical means as pumps, bellows, fans, or jets. Of recent years, this method has gained increasing popularity especially in the ventilation of large buildings, mines, ships, and other structures where natural ventilation has proved unsatisfactory. Present day air-conditioning is an example of mechanical ventilation.

The replenishing of air artificially may be accomplished by several different methods, or, by a combination of them.

1. *Vacuum method* is used in smaller buildings, in kitchens, or industries in which the air is being continually contaminated with dust, fumes, or smoke. It consists of a fan, or several fans, designed on the suction principle to draw air out of the rooms, and natural openings or duct systems to permit the entrance of fresh air.

2. *Plenum method* finds its greatest use in larger buildings such as hotels, large steamships, deep mines, subterranean rooms, and the like. It employs large fans which force fresh air into the rooms and replace the impure, resident air.

3. *Vacuum-Plenum method* combines the vacuum fan to withdraw impure air with the plenum fan to force in a constant supply of fresh air. It is the most satisfactory system and is often used in conjunction with apparatus to heat or cool the air as well as humidify it. It has found widespread use in larger public buildings, restaurants, and similar edifices.

4. *Air conditioning* is the popular term applied to mechanical ventilation, usually of the vacuum-plenum type in which air is properly humidified and heated or cooled to provide a maximum of body comfort. Usually the air is subjected to washing or passed through water to remove dust, cinders, bacteria, and other foreign bodies. It will not, however, effectively reduce odors unless a special deodorizing process is also used at the time of washing. Properly controlled, this system will supply air of unexcelled hygienic purity.

The advantages of air-conditioning—purity of air, correct temperature, proper humidity, and constant circulation—are obvious, but may be harmful to the human body if the process is unwisely carried out; such as setting the temperature at a low level when the atmospheric temperature is much higher, or when the humidity difference is very great between inside and outside air. This places a great strain upon the adaptative processes of

the body and in some instances seems to manifest itself in various repiratory disturbances, a chilled serous circulation, and other evidences of disturbed metabolic activities.

Requirements of a Satisfactory Ventilating System. In order for a system of ventilation to serve the best interests of the human body, it should fulfill four primary requirements. These are:

1. The air must be of a proper temperature and humidity.
2. The air must be clean and free from odors.
3. The air must be supplied in proper amounts.
4. The air should be circulated at proper velocity.

Of course the efficiency of such a system is dependent upon the type of room being supplied, the number of inhabitants of the room, and the use made of the room. For crowded places, such as theaters and auditoriums, a satisfactory means of ventilation is essential to public health. Unfortunately, the practice of overheating may spoil the effects of an otherwise adequate system. It is surprising how great an improvement in a poorly ventilated room or a "stuffy" office may be obtained by lowering the temperature a few degrees. To a large extent, the lack of adequate ventilation in many instances may be traced directly to overheating, rather than to an inefficient system of air supply. On this basis then, good air is primarily cool air, with a moderately low humidity, with adequate movement and constant replenishment.

Proper temperature and humidity. Those figures most generally accepted by hygienists as being the optimum conditions for ordinary living or working conditions are a temperature of not over 68 degrees Fahrenheit and a relative humidity of 40 to 60 percent.

HUMIDITY

Humidity is the amount of moisture present in the atmosphere. The presence of this water vapor or moisture is directly dependent upon the temperature of the air in which it is contained and not upon the amount of air. Humidity is always present and

always varying in the atmosphere and since it affects the health of the body, it is an important hygienic factor. The two most common terms applied to humidity are those of actual and relative humidity.

Actual or absolute humidity. This is the actual amount of vapor in the atmosphere expressed in grains per cubic foot. It is dependent on the temperature of the air, and represents the maximum amount of water vapor the air can hold at a given temperature before it is saturated.

Relative humidity. The percentage of moisture in the air at a given temperature as compared to amount necessary to cause saturation, which is taken as 100. For example, the relative humidity at 70 degrees Fahrenheit would be 50% if the air held 3.88 grains per cubic foot, because the saturation point of air at 70 degrees is 7.8 grains of water per cubic foot. The air can contain, at 90 degrees, almost twice as much as at 70 degrees—14.3 grains per cubic foot before saturation occurs.

Relative Humidity is most commonly determined by the use of the *sling psychrometer.*

The sling psychrometer consists of two similar thermometers, one with a dry bulb, and the other called the wet bulb is covered with a muslin saturated with water. The instrument is swung rapidly through the air for about twenty seconds and then both bulbs are read quickly. This procedure is continued until two consecutive readings of each bulb agree closely and the difference between the wet and dry bulbs is recorded. At the same time, a barometric reading is made and this information is added to the temperature of the air and the result is used to ascertain the relative humidity by computation from a standard relative humidity table.

The dry bulb indicates the temperature of the air itself; while the wet bulb, cooled by evaporation, usually shows a lower temperature according to the degree and rapidity of evaporation. Thus, when these results are checked against a standard table,

determination of the amount of aqueous vapor in the air is an easy process.

It has been estimated that the ordinary room contains one and one-half gallons of water per twenty-four hours, and a six-room house has a total of eight gallons of water present per twenty-four hours if the humidity in the rooms is from 30 to 40 percent.

Effect of warm, moist air. In warm, damp air, the bodily temperature rises and the pulse rate increases with a corresponding decrease in the mental and physical activities of the individual. This type of air produces labored respiration, which is nature's attempt to cool the body surface through moistening the surface of the skin and evaporation. An individual suffering from a vertebral subluxation, which makes adaption to atmospheric conditions difficult, if not impossible, may suffer from heat exhaustion when exposed to a temperature of 90 degrees Fahrenheit and a relative humidity of 75 percent.

Warm, moist air may be considered detrimental to a person suffering from the gout, rheumatism, or arthritis, because the high humidity diminishes elimination through the sweat glands. Consequently, certain poisons, such as uric-acid derivatives, are retained within the system.

Hot, moist air may even have an effect upon racial characteristics. For example, the natives of equatorial Africa, where the climate is predominately hot and humid or "sultry," are characteristically shòrt of stature, poorly developed muscularly, inferior mentally and of languid disposition.

Certain diseases are more prevalent in a climate normally hot and moist; most of which are called tropical diseases, and these include malaria, yellow fever, cholera, dysentery, sleeping sickness, and typhoid.

Effect of warm, dry air. This is the most hygenic of all air conditions because it places the least adaptive strain upon the human body. The regulation of the body temperature, or thermotaxis, is dependent upon proper nervous control of the vaso-

motor systems, perspiration, heat centers in the brain, and similar physiological activities. Warm, dry air is admirably suited to nicely balance these activities so that body temperature is maintained at a normal level with a minimum of difficulty. Of course, this may be overdone if the air is hot and dry, with the result that too much body moisture is lost through evaporation. If not replaced, such loss will be fatal to the human body, because when 21% of the water content is lost through evaporation or other means, death will follow.

The cooling properties of the external air are determined both by its own temperature (ability to cool by conduction of heat) and its dryness (ability to cool by evaporation). Since air in contact with the skin will soon reach the same temperature as the body, and the amount of water vapor on the skin will reach an equilibrium with the water vapor in the surrounding air, it is necessary that the air be continually fresh and circulating. A slight amount of circulation is always present due to the rise of warm air around the body, but this may be greatly increased, with a consequent increase in cooling properties, by air set in motion from a breeze, or fans. Air at a temperture of 75 degrees, which brings about profuse perspiration, may be set in motion so that its actual power of cooling by extracting heat from the body would be the same as quiet air of a cool 68 degrees.

Rheumatic and arthritic cases would be benefited by living in a warm, dry climate, because it has the opposite effect upon the heat regulation of the body as that of a warm, moist climate.

Effect of cold, moist air. This type of air is also a strain upon the human body in that it quickly chills, thus overworking adaptation. Low temperature, plus high content of water vapor, are two factors both of which tend to cause rapid loss of body heat by dissipation into surrounding air. This climatic condition is injurious to patients whose excretory systems are below par functionally such as rheumatism cases.

Effect of cold, dry air. The action of cold, dry air is one of

exhilaration and increased metabolic rate; consequently, it is beneficial to the welfare of the body. Cold, dry air tends to keep the warm blood from circulating too freely through the skin where much heat would be lost. The lowered temperature cools by conduction of heat from the body surface, and the low content of water vapor allows much cooling by evaporation of perspiration. The New York Commission on Ventilation found that school children working in air with a humidity of between 30 and 40 percent of saturation and a temperature of 75 degrees Fahrenheit, did 15% less work than at 68 degrees F., and 37% more work than at 80 degrees. From these figures, the conclusion may be drawn that dry air of a lowered temperature is more satisfactory for general body activities.

The amount and type of clothing worn is an important factor in determining the healthful features of any temperature. The matter of season is of importance also. For example, an indoor temperature of 70 degrees ideal in winter might feel extremely warm and uncomfortable in mid-sumer. This latter, of course, is evidence of Innate's intellectual adaption to existent environmental circumstances. At times this may be sorely overtaxed by the modern speeds of transportation in which a person may leave the cold and dampness of the Chicago lakefront on a mid-January night and in the morning alight in the warm, dry air of Los Angeles. This transition may produce temporary discomfort until Innate can adapt to the new environment.

Climate and Health. From a hygienic standpoint, the environmental conditions best suited to health and which place the minimum burden upon the adaptative processes of the body, are an even temperature, dry atmosphere, pure air, abundant sunshine, moderate altitude, and pure water supply. When a person is advised to change climates for the sake of health, such a step is technically known as *climatotherapy* or *climatotherapeutics.*

AIR AND DISEASE PRODUCTION

It is popularly believed that the air is a common carrier of

much disease, and many misconceptions and bizzare preventives have been expounded concerning its dangers under certain circumstances. Actually, there are very few diseases readily transmitted though the medium of air. Tuberculosis has come in for more than its share of discussion, yet its infectivity through air is very slight, even when ground into the dust of the air, or in droplets coughed out by the tuberculous patient. A common fallacy still widely prevalent is that night air is the source of certain diseases such as malaria. This has been thoroughly disproved. The only possibility of danger in night air is that mosquitoes are more common at night time. Thus, it is not the air which may be condemned, but the insect which carries the infectious agency. Swamp air, or air containing a large amount of decaying organic matter, once was considered unhealthful, but this also has been disproved. The odor of decaying materials cannot be held responsible for disease production even if the odor is very pronounced. It was also assumed that sewer air was capable of carrying disease, but air from sewers was carefully examined and it was found relatively freer from bacteria than air in the home or public buildings. Occasionally, sewer air may contain illuminating gas from leaking gas mains, but this would produce gas poisoning, and not any infectious disease.

On this basis then, the air is probably the least dangerous part of our environment as far as disease transmission is concerned.

AIR PRESSURE

The air pressure at sea level under normal circumstances is about 14.7 pounds per square inch. An adult male has a total pressure of 34,000 pounds against the approximately ten square feet of his body surface. This figure will vary but slightly, in fact, man would notice no particular distress if he climbed to the top of the highest mountain or descended to the depths of the deepest mine. This is due to adaption by the body to the change in air pressure. However, when artificial pressures are produced the

body may not be able to cope with the changes with sufficient speed to ward off distressing, and perhaps serious, consequences. The body can and will adapt to changes of environment factors if given time and opportunity, but in some instances too pronounced and too swift changes make adaption impossible.

Increased air pressure. Greatly increased air pressures are encountered in those occupations requiring man to work under ground or under water, where high air pressure must be introduced to counteract the crushing pressure of the water or ground, as in deep-sea diving or caisson work.

In deep-sea diving, it is necessary to increase the air pressure 14.3 pounds per square inch for every 33 feet of depth in order for the diving apparatus to hold back the weight of the sea. At a depth of about 100 feet, the necessary air pressure would be 4 atmospheres or about 60 pounds per square inch of body surface. The deepest dive on record is almost 600 feet, which subjected the diver to an air-pressure of some 360 pounds per square inch. The danger from the increased air pressure comes during the ascent when decompression commences, particularly if done rapidly. However, the descent may be accompanied by certain symptoms such as light-headedness and mental confusion, due to the rapid passage of nitrogen into the blood, leaving the oxygen content of the air too concentrated for proper respiration. This tendency is partially overcome by using a mixture of oxygen and helium, instead of normal air with its high nitrogen content. The helium goes into the blood at only half the rate of nitrogen.

The mixture of helium and oxygen may also prevent the "bends" or Diver's palsy or Caisson disease. A diver, or caisson worker, gets the "bends" when bubbles of dissolved nitrogen collect in the blood stream and tend to localize in the joints. It results after the worker has left an area of increased pressure, not decompressing himself slowly enough to allow nitrogen to be thrown out of the blood stream and tissues of the body. The normal rate of ascent is 25 feet a minute with one minute rest

at each stop. In a case of the "bends," the greatest complaint is of muscular and articular pains of great severity, with drawing and tightness of the joints. In severe cases, there may be a light, foamy, blood-flecked sputum, cyanosis, dyspnea, and finally coma and death. Physiologically, it has been shown that a thin worker is much less susceptible to the bends than one fleshy, because fat absorbs and holds nitrogen.

The victim of "bends" or Caisson disease is placed immediately in a decompression chamber where the air pressure is increased to the point where his pain is eased, then one more atmosphere, or an extra 14.7 pounds per square foot is added. Over a period of hours, gradual decompression is brought about giving the body time to adopt itself back to normalcy. Many workers carry instruction tags telling the location of the nearest decompression chamber and other pertinent data which may be invaluable in the event they are found unconscious and suffering from the "bends."

Decreased air pressure. The effects of decreased air pressure upon the body may be severe beyond certain levels. However, the reaction upon a normal individual who makes a gradual ascent to a high altitude is negligible, because of the powers of adaption resident in the body.

The body equilibrium may suffer profound disturbances at excessively high altitudes such as are possible in aircraft. For example, research into the effect of high altitudes upon the body has shown a gradual increase in blood pressure up to an altitude of 25,000 feet, followed by a sudden drop in blood pressure, indicative of a temporary failure of the heart to continue circulation. This seems to be due to the decreased amount of oxygen in the rarified atmosphere found at this level. Unconsciousness, or "blacking out," is a common manifestation of loss of body equilibrium. It occurs when the oxygen content of the air falls to such a low level that tissue cells are unable to receive sufficient for their ordinary needs, even though the circulatory system works

doubly hard as evidenced by raised blood pressure and increased heart rate.

"Mountain sickness" is the term applied to that group of symptoms appearing in individuals who are unable to adapt to the decreased oxygen content found at high altitudes. This may be due directly to a vertebral subluxation of recent occurrence, or to impaired circulation from a weak heart or vascular system. Impaired respiration from pulmonary disease of long standing may also contribute to it. A person suffering from mountain sickness experiences dizziness, ringing in the ears, drowsiness, mental apathy, confusion, and perhaps, unconsciousness. Usually the symptoms leave upon returning to a lower altitude. Because rarified atmosphere increases cardiac and respiratory action, undue strain may be placed upon tissues already weakened by lack of proper nerve supply. Among such cases can be included those of advanced tuberculosis, arteriosclerosis, emphysema, and certain other infections of the lungs, heart, and kidneys. The best interests of hygiene would be served by suggesting to such persons that residence in a high altitude might be dangerous.

CHAPTER XVIII

Heating

Heating is closely related to the preservation of health. Practically all accommodations which man occupies for any length of time must be heated at certain periods of the year in order to complement production of heat by the body. There are certain forms of heat produced by various methods and it is with their hygenic values that we are concerned, not with the engineering principles involved.

Heat is defined as the energy that produces the sensation of warmth. It exists in the form of molecular or atomic vibration. The source of body heat is primarily the oxidation of foods. It is lost from the body by three main channels, the skin, lungs, and excreta. It has been estimated that the skin loses 87.5 calories, the lungs 10.7 calories, and the feces and urine 1.8 calories per 100 calories of heat obtainable. Heat is lost from the skin by radiation and convection when the external temperature is lower than that of the skin surface. Heat is lost also through the evaporation of sweat because the evaporation of any fluid absorbs heat from the surrounding objects or air. Body heat is lost through conduction when the surface of the body comes in contact with substances colder than itself. Loss of body heat that is too slow or too rapid places a severe strain upon the adaptative apparatus of the body with subsequent discomfort and possible deleterious effects.

EFFECT OF CLOTHING UPON BODY HEAT

One method of heat control which has a far-reaching influence upon general body health is that of proper clothing. In cold weather garments prevent the body from using too much fuel for warmth. In hot weather light colored clothing reflects heat. Air

spaces in fabrics such as wool, fur, and feathers, are poor conductors of heat, so these fabrics are warmer than cotton, linen, or leather. It is the texture, not the material, which makes for warmth; so woolen fabrics lose in warmth when they are matted down and the air spaces destroyed. In the colder weather, it is not only a question of heat retention, but also of the power of a garment to absorb and hold sweat. Knitted fabrics absorb and dry more readily than those woven of the same material. Body heat is increased when the moisture from wet garments cannot readily evaporate. Because of this, wool, which absorbs moisture readily and parts with it slowly, prevents chilling by rapid evaporation after one has worked himself into a sweat.

Winter clothing should be made of materials designed to conserve body heat so that comfort is found with temperatures of 68 to 70 degrees F. Since the skin is dry; small, sudden changes in temperature are not noticeable.

Summer clothes should be designed to provide a maximum of heat loss from the body surface by dissipation. As the skin is usually moist under summer temperatures, the body reacts to small changes in temperatures caused by increased evaporation.

ARTIFICIAL HEATING

Heat may be produced artificially by the combustion of gas, oil, wood, coal, or peat. Its production may be so controlled as to be of great value in helping maintain normal body heat balance.

There are three *methods* of transferring heat; radiation, conduction, and convection. There are two *systems* of heating, namely, local and central. Methods and systems should not be confused.

Radiation is the process whereby heat passes from one point to another in a straight line with great speed. Radiant heat is that given off by a fire-place, a gas heater, electric heater, or from the walls of a stove. The radiation of heat through air is rapid although conduction is poor.

Conduction is the process by which heat passes from one particle of matter to another. The passage of heat through the walls of an iron stove is an example of conduction. After passing through the walls the heat is dispersed as radiant heat.

Convection is the process whereby heat is generated at a distant point and is transported to where needed by convection currents of air, steam, or water circulating in enclosed ducts. The movement is due to the heating of air or water molecules which rise and cooler air or water moves in to replace them, as seen in steam heat in which steam rises to replace the colder fluids in the system.

LOCAL HEATING

Local heating refers to the production of heat within the confines of the room requiring it. Heat may be generated in the apartment where it is required, by combustion in fireplaces, stoves, braziers or electric radiators. This system is not satisfactory in most instances because it tends to vitiate the air, produces impure waste products of combustion such as carbon-dioxide, rarely gives a uniform heat, and does not provide the proper humidity required for hygienic heating. However, a local system may improve the ventilation of a room since an open flame attracts currents of air for proper combustion.

Fireplaces give off heat by direct radiation but are an unsatisfactory means because 50 to 75% of the heat is lost through the chimney. Further, a fireplace is subject to the law of heat transmission, which states that the intensity of the radiated heat is inversely proportional to the distance of the object receiving it from the source of the heat. A person seated one foot from a fireplace will receive sixteen times more heat than one seated four feet away. In order to reach its peak of efficiency as a heating unit, a fireplace must be scientifically engineered. Since the average fireplace is not so constructed, it fails badly as a good source of heat. The danger of fire from sparks and embers must not be

discounted. On the other hand, the psychological effect and comfort derived from a fireplace, compensates for its shortcomings as a heating unit providing some other form of heat production complements its use.

Stoves made of iron or other metals may provide plenty of heat but have the same disadvantages as found in any other local heating system. They produce impurities, deliver an uneven, poorly distributed heat, and are a source of dirt and dust.

CENTRAL HEATING

A system of central heating is by far the most satisfactory method because the source of heat is removed from the inhabited parts of a building. The heat is conveyed from its source by means of air, hot water, or steam, through a system of ducts or pipes.

Hot Air is a popular and quite satisfactory method of heating for smaller homes and buildings. The air is heated by furnace and distributed by a system of ducts opening into rooms with a cold air return for reheating by another system of ducts. Objections to this form of heating are based upon the dirt and dust which may be circulated by it, particularly the accumulation of dust when the system is idle. The possibility of carbon monoxide being present must be considered, especially when the furnace is overheated. Perhaps the greatest drawback to heating by hot air is that of inadequate humidification, which results from absorption of moisture by the hot, dry air. This dry heat may evaporate the fluids on the cutaneous surface of the body so rapidly that one may feel cool even though the air temperature is comparatively high. In addition, this dryness may affect the mucous membranes of the upper respiratory tract, particularly the nose and pharynx.

Attempts are made to overcome this difficulty by placing pans of water on the radiators, or by humidifying apparatus which

restores moisture to the dehydrated air. The great amount of water necessary to maintain comfortable humidity, may be seen from the fact that, when air at 20 degrees Fahrenheit is heated to 68 degrees Fahrenhit, it is necessary to exaporate 5.2 quarts of water each eight hours in an average-sized room occupied by one person.

The original central heating system was hot air, with circulation being achieved by the expansion and rising of the heated air through the conveying ducts. This required that the air be very hot, to effect complete circulation against the resistance of cold air ahead of it. Modern adaption of this method uses a fan to blow the air through the ducts with a substantial saving in heating costs and greater convenience.

A pipeless heater is a form of hot air system which has a single large register to discharge the heat, rather than a system of ducts. Hot air is discharged from the center of the register and cold air is returned to the furnace through openings in the corners of the register. This system is satisfactory only in a small, compact house that has plenty of openings between the rooms to allow free circulation.

Hot Water is a very satisfactory system of central heating. It works on the principle that when water is heated, it expands and as it then occupies more space for its weight, it becomes lighter and rises. Pipes are placed running upwards to carry the hot water through a system of radiators and other pipes drain the cooler water back to the furnace for reheating. The hot water system requires the water to be of a temperature less than that of steam, consequently it is necessary to install larger radiators than in the latter system, a fact to be considered when faced with limited floor space. Also, two pipes per radiator are usually necessary, and only one is required in steam heat. However, the hot water system has the advantage of retaining heat longer than steam. Compared with hot air there is less danger of overheating

the air and greater possibilities of humidification with the hot water system.

Steam heat. In the steam heating system, steam produced in the boiler flows through pipes to the radiators. These, being cooler than the temperature of steam, condense the steam which in returning to the form of water, gives up heat that is absorbed by the metal radiators. The water formed in the radiators flows back to the boiler to be reheated. This system is very satisfactory for medium sized homes or large buildings, particularly those that are high or irregular in design and shape. Because of its nature, steam is used extensively with air conditioning apparatus which cleans, humidifies, and circulates the air.

Automatic Heat is best exemplified in the use of gas as a source of heat, but oil or coal also may be used as fuel. When such a system is properly installed in a home or building that has been well constructed, it offers an excellent source of heat, free from the care and thought which is one of the detriments of most forms of heating by air, steam, or hot water. A gas furnace, for example, is entirely automatic and requires no attention throughout the entire heating season.

HYGIENIC REQUIREMENTS OF HEATING SYSTEM

In order for a heating system to operate in the best interests of the health of the persons concerned, it should fulfill the following requirements:

1. It should be of sufficient size to supply adequate heat.
2. It should distribute the heat evenly and uniformly.
3. It should provide heat free from dust and other impurities.
4. It should provide heat with the proper degree of humidity.
5. It should be economical to operate.
6. It should be free of the dangers of explosion and fire.
7. It should be relatively easy to tend.

EFFECTS OF HIGH TEMPERATURE UPON THE BODY

In order to maintain the life of a warm blooded animal, it is necessary to keep the body temperature constant, notwithstanding external and internal conditions which tend to raise or lower it. When the human body temperature falls to about 77 degrees Fahrenheit and is maintained at this level for several hours, death will follow. On the other hand, a temperature higher than 111 degrees Fahrenheit will cause death after a short time. Since man is a warm-blooded animal, he has the power to maintain a relatively stable body temperature, irrespective of external temperatures, provided the physiological factors governing such regulation are allowed normalcy. However, his power of adaptation to variable atmospheric temperatures is dependent upon a properly functioning nervous system and a normal supply of nervous energy to all cells of the body. Even when such a state of normalcy exists, he is subject to some degree of discomfort, and actual danger, when the temperature of the air reaches a sufficiently high or low point that adaptation cannot overcome it and damage to the tissues results.

Man has marvelous powers of adaptation to wide temperature variations. At the present time, he can survive in sub-zero temperatures as well as those above 120 degrees Fahrenheit. However, there are certain temperature levels at which man is most efficient in his activities because they place the least amount of strain upon his thermogenetic and thermolytic centers. For work that requires strenuous physical exertion, a temperature of from 60 to 64 degrees is best; for moderate physical exertion, a temperature of from 64 to 66 degrees; and for sedentary work, temperatures of from 66 to 68 degrees are best. It is advisable that the temperature of the air not exceed 70 degrees Fahrenheit. These are optimum temperatures, when supplied artifically by heating systems, although such temperatures would also be desirable in natural climatic circumstances.

In the event that man has an interference with the normal

transmission of mental impulses between the brain and tissue cells of his body, due to a vertebral subluxation, his powers of adaptation to high external temperatures may be greatly decreased, perhaps sufficiently so that the body is unable to cope with the added strain placed upon it by exposure. If such is the case, he may suffer a condition of heat exhaustion or heat stroke, a common and serious consequence.

Heat Exhaustion. It is important that this condition not be mistaken for heat stroke. The method of treatment is entirely different, and incorrect interpretation of the conditions may result in care which is detrimental rather than helpful. Heat exhaustion usually follows prolonged exposure to high temperatures in which the relative humidity has been high (75% to 90%). The case notices a nausea, weakness, vertigo, and may vomit. Very soon the skin appears pale, moist, and cool. The pulse is rapid, respirations are shallow, and unconsciousness soon follows; a typical shock reaction in all its symptoms, and a very serious condition, too, as the mortality rate is above 50% in all untreated cases. The care of such a case is intended primarily to raise the lowered body temperature by the application of heat and other appropriate shock treatment.

Heat Stroke. This condition is usually the result of exposure to the direct rays of the hot sun or hot dry heat and occurs most frequently in debilitated persons such as alcoholics, heart cases, or kidney cases. A person suffering from fatigue is more susceptible to heat stroke than one who is properly rested. It starts in its initial stages quite similarly to heat-exhausion, namely, nausea, vertigo, and weakness. However, the skin becomes flushed, hot, and dry, and the pulse is fast and weak. The outstanding symptom is the much elevated temperature of the body which commonly reaches 108 degrees Fahrenheit and occasionally 112 degrees, but such cases rarely, if ever, recover. It seems that the heat regulating centers in the hypothalmic region of the brain are literally "burned out." Methods to combat heat stroke are

intended to lower body temperature; such as the application of cool cloths, cool baths, etc.

HEAT AND INFANT MORTALITY

Children, particularly infants, are susceptible to the prolonged high temperatures of the summer months and may react severely to such exposure because of undue exertion. In large cities, the heat may be increased by overcrowding, inadequate ventilation, and heat reflected from concrete walls and walks, or buildings. There is a tendency on the part of many mothers to overdress their children. A common complaint met by the chiropractor is that of "summer diarrhea" or "summer complaint," which is a gastro-intestinal upset resulting from prolonged high temperatures prevalent at this time. The delicate nervous system of the infant has not had sufficient time to adapt to such sustained high temperatures and the result is manifest in diarrhea, fever, vomiting, and general fretfulness and lack of vitality. The chiropractic prognosis is excellent in such cases.

Foodstuffs, such as milk, are apt to undergo chemical changes of a toxic nature in the absence of adequate refrigeration, or care, and this partially explains the increased infant mortality rate at this period of the year. Flies, and other insects, may deposit filth and other deleterious substances upon the surfaces of foods and thus expose the child to further hazards when his energies are already taxed.

HEAT CRAMPS

These are severe, intermittent cramps of muscles of the abdomen and extremities. It occurs in individuals exposed to a hot dry temperature for a prolonged period, such as in steel mills, paint drying rooms, and other occupations. Heat cramps are not uncommon during the summer months among individuals who perspire profusely, particularly those who drink large quantities

of water. Generally, an individual is more susceptible to heat cramps when he has an insufficient intake of common table salt during the summer months or when engaged in occupations where he is exposed to much heat. Although not a fatal disease, it produces severe discomfort and is characterized by excessive perspiration, cramps in the arms, legs, and abdomen, with some fever and elevation of the blood-pressure. Since the tissue cells of the body lack the proper quantity of sodium chloride to carry on normal function, heat cramps may be prevented in some instances by the regular ingestion of one to three hundred grains of salt each day, an amount which compensates for the sodium chloride lost in two quarts of perspiration. The salt aids in holding water in the tissue cells. When salt is depleted by sweating, cells become "dry" and thirst results—a demand by nature for water.

HEAT THERAPY

Heat therapy is a phase, or division, of physical therapy, which includes the use of all physical remedies in the treatment of bodily disability or disease, exclusive of surgery and medicine. As was explained in the discussion of light therapy, we as Chiropractors do not in any way condemn the use of heat modalities in the treatment of disease. We do maintain it is not a part of the practice of chiropractic because it is entirely at odds with the prime tenet of our science, namely the adjustment of the spinal column to correct the cause of disease. Since it is not a concussion of forces scientifically applied to arouse an internal concussion of forces which will correct a subluxated vertebra, it cannot be construed as chiropractic technique. However, it does have certain hygienic applications relative to the human body and because of this, a brief consideration of its more salient features is warranted here.

There are three forms of heat produced by thermal modalities. These are:

1. Conductive heat which is heat absorbed by direct contact from a hot surface such as a hot water bottle, hot pad, hot compress, or hot bath.

2. Convective heat is based upon radiant energy flowing from the source by way of radiation through the air to the body where it is absorbed. An example of convective heat is seen in sunlight, a fireplace, infra-red and deep therapy lamps.

3. Conversive heat is heat produced by the tissue cells themselves in their resistance to the passage of a high frequency current through them. This is also called direct heat, and is best shown in a diathermy machine.

DIATHERMY

Diathermy is the therapeutic use of the high frequency current to generate heat within some part of the body. The frequency of the current is greater than the maximum frequency for neuromuscular response and ranges from several hundred thousand to some millions of cycles per second. The diathermy machine generates this high frequency current which is conveyed to the body of the patient by means of insulated copper wires and then spread over a designated surface by plates of block tin called electrodes.

As this rapidly oscillating current passes through the cells in its path, the cells offer resistance, creating friction which in turn produces heat. Accordingly, conversive heat is set up in all the tissues between the two electrodes placed on opposite sides of the body. This type of heat therapy is used to relieve deep seated pain and vascular congestion.

Some of the more common conditions which are treated by diathermy include nephritis, pneumonia, hrepatic colic, dysmenorrhea, neuritis, rheumatism, and sinusitis. However, there are certain conditions in which the use of diathermy is contraindicated and may actually be dangerous; these include ulcers

of the gastro-intestinal tract (because of the danger of hemorrhage), purulent tuberculosis, and through the pelvic region when pregnancy or menstruation is present.

CHAPTER XIX

Food Poisoning

Food is rarely sterile, because micro-organisms in the forms of bacteria, yeasts, and molds, are usually found as well as occasional higher forms of animal life such as maggots of flies, trichinae, and intestinal worms. Because these are consistently present in food, particularly in raw foods, their mere presence cannot be considered a basis for condemning a food as unfit for human consumption. A much more important factor than mere presence is the number and kinds of these organisms. They may affect the character of the food in several different ways: bacteria capable of setting up infectious disease may be present; exotoxins, endotoxins, and ptomaines, may be liberated by bacterial metabolic activities; or certain other changes affecting the palatibility of the foods may be brought about.

Chiropractically, a food is any substance which can be used by the body to its best interests for tissue cell activity. If infectious organisms are present in food, the healthy body can take care of them. However, when endotoxins and ptomaines are present these poisons may be so violently toxic to the body cells that effective resistance may be impossible and fatal results may occur. For example, the toxin liberated by the Bacillus botulinum is one of the most deadly poisons known, the mere tasting of foods contaminated with it having been known to cause death.

FOOD INFECTION AND FOOD INTOXICATION

For many years it had been assumed that many cases of illness occurring after the ingestion of tainted food were due to the presence of ptomaines, which are poisonous substances resembling alkaloids, formed by micro-organisms in the latter stages of

putrefactive action upon protein. However, this terminology was found unsatisfactory and dropped from general usage. The fact is, if true ptomaines were present in food, the food would be so decomposed and offensive to smell and sight that it would be rejected by the purchaser.

Today, a "food infection" is known to be brought about by food which conveys certain bacteria to the gastrointestinal tract, where they undergo a rapid increase and set up an acute gastrointestinal inflammation. The most common organisms associated with food infection are the paratyphoid bacilli and the members of a group of organisms known as Salmonella. Meat seems to be the major source of food infection and it is assumed that the infective bacilli reach the meat from outside sources such as contamination during slaughtering, or being carried by flies, or blown by dust. Vegetables may be infected by the use of human excreta as fertilizer, or by being washed in impure water.

The symptoms of food infection are nausea, emesis, diarrhea, and fever, all of which may begin six to twelve hours after ingestion of the contaminated food. The mortality rate is about 2 percent.

The best means of preventing food infection are clean handling of food, proper cooking, proper refrigeration after cooking, and the separation of diseased individuals from food handling.

Food intoxication is almost always referred to synonymously with *botulism* which is a specific food intoxication associated with the Bacillus botulinus or so-called "sausage-bacillus" because it was first described in connection with spoiled sausage. The toxin, not the organism, is responsible for the swift effects and frequent fatalities of botulism. The organism may grow for several weeks or months in foods, elaborating a chemical toxin which is unusually poisonous. However, one seldom hears of botulism today except for sporadic outbreaks where a group of

Clostridium welchii spore form. and is resistant to boiling average incubation period 15 hrs. Same symptoms only no vomitting

people have partaken of the same contaminated food. Commercial canning of foodstuffs has replaced much of the home-canning of former years, the canneries employing elaborate precautions against food contamination of this sort. Their precautions include careful handling of the food, its thorough sterilization by heat, and proper sealing of the containers. A temperature of 120 degrees Centigrade for 10 or more minutes will destroy the bacillus and any of its spores.

Symptoms of botulism usually appear within 24 hours after ingestion of the contaminated food. The toxin is absorbed directly from the stomach and intestines and seems to have a special affinity for nervous tissue, producing a flaccid paralysis particularly of the face and throat. There is general muscular weakness, double vision, thickness of speech, and difficult deglutition. Death is the result of cardiac failure, or asphyxia, and results in about 90% of the cases.

The foods commonly associated with botulism are sausage and pork, and such canned vegetables as spinach, beans, peas, asparagus, and olives. Acid foods such as pickles, and food containing sugar solutions such as jams or jellies seldom cause botulism because they are inimical to the growth of the organism.

FISH AND SHELL-FISH POISONING

Many forms of poisoning follow the eating of contaminated fish and shell-fish. Most of these are associated with a toxin liberated by the botulism organism. Fish foods became contaminated following inadequate care after removal from the water. Modern refrigeration methods and rapid transportation facilities have greatly lessened this danger, although many shell fish, such as oysters, are still not used in the warm months, May to August, or the months without "R" in their names. Poisoning from fish and shell-fish produces virtually the same symptoms as typical botulism. In some instances, the body of the fish is

poisonous in itself, such as the sexual glands during spawning, or because of poison glands connected with protective barbs. Poison natural to the fish is called *Siguatera.*

NATURE OF FOOD POISONS

Bacterial toxins found in food are for the most part similar to the toxins of the pathogenic bacteria. For example, the toxin of tetanus and the toxin of botulism produce similar effects upon the human body. However, they differ widely in that the poison of tetanus can be swallowed with impunity and yet a taste of botulism toxin may be sufficient to cause death. The simplest of these compounds belong to the alkaloids and are called ptomaines. Several of these have been prepared in the pure state such as mytilotoxin from poisonous shell-fish, and neurin from putrified beef. Cadaverin and histamin are also mentioned as possible types of toxin produced by the decomposition of proteins.

FOOD ADULTERATION

Prior to the passage of the Pure Food and Drugs Act of 1906 about 50% of all food consumed was more or less adulterated. Rigid enforcement of this statute has now cut the amount of food adulteration to a negligible amount and the health of the public thereby safeguarded.

A food is said to be adulterated when it has undergone any of the following processes:

1. Mixed with another substance to lower its strength.
2. Its valuable part partially or wholly abstracted.
3. A substitution made either in whole, or in part.
4. When poisonous substances are present.
5. When decayed animal or vegetable matter is present.
6. When stained or colored to conceal inferior quality.

Common adulterants employed before the enactment of the Pure Food and Drugs Act and the food involved were: clay in

candy; lard in cheese; brick-dust in cocoa; dates and acorns in coffee; gelatin in cream; talc in flour; formaldehyde in milk; cereals in sausage; and pumpkin and apple pulp in ketchup.

POISONS IN FOOD

Nowadays the presence of chemical poisons in foods is a rare occurrence unless introduced by accident or design. For this we can thank enforcement of the Pure Food Act and the alertness of food chemists. For example, it was a popular practice at one time to color foods to increase their appetizing appearance, but subsequent tests showed that the coloring agents were toxic to the human body. These agents included copper sulphate and certain analine dyes containing arsenic and lead. However, a list of harmless coloring agents known as "allowable colors" is now conformed with and the label of the product must state that artificial coloring has been used. In some cases, the use upon fruit of insect sprays containing arsenate of lead has been known to produce illness.

CHAPTER XX

Milk

Fresh, normal milk is one of the most important of human foods. It has widespread popularity as food and beverage, because of its pleasing taste and aroma. Milk is the only substance found in nature designed expressly for the use of the young animal. It is oftentimes called the perfect food because it contains all five of the food principles. Cow's milk has the following average composition:

Fat	4%
Lactose	4.5%
Nitrogenous (casein, albumen, etc.)	3.5%
Minerals	0.7%
Water	87.3%
	100.0%

Because of the nature of milk and the circumstances surrounding its production and handling, it is more susceptible to undesirable changes than any other food. The two most common injurious changes occurring in milk are those due to absorbed taints and odors, and to micro-organisms.

ABSORBED TAINTS AND ODORS

Milk is rapidly affected by many different odors. It may acquire an objectionable odor before leaving the udder of the cow if the animal has eaten such strong feeds as onions or cabbage. If exposed for any length of time to malodorous compounds it will absorb these very rapidly. If placed in an unsealed container within a refrigerator it will absorb the odors of cabbage, turnips, strawberries or pineapple, and although these foods are pleasantly aromatic in themselves, the resultant combination gives an unpleasant taste to the milk.

CHANGES RESULTING FROM MICRO-ORGANISMS

Most of the unpleasant changes occurring in milk are due to the activity of micro-organisms. In contrast to absorbed taints and odors which decrease with the age of the milk, micro-organic changes are increased as time goes on. Because milk is such an excellent culture medium for bacteria it is particularly susceptible to bacterial changes. These include the commonly observed reactions of curdling, souring, formation of ropy milk, bitter flavors, and gassy milk, as well as others. Such changes take place readily because the sugars and proteins present in milk are easily attacked by bacterial activity. Theoretically, if germ-free milk could be produced and maintained, it could be kept fresh for an indefinite period of time.

SOURCES OF BACTERIA IN MILK

1. *Mammary glands.* Milk as secreted by the normal udder of a healthy cow is considered free of contamination, that is, it is sterile. However, during milking, as it passes down through the milk ducts, it picks up a large number of organisms. These bacteria may be of the type which merely produce chemical changes, or they may be pathogenic to man.

2. *Exterior of the Cow's Body.* The hair and skin of the cow may be great sources of contamination during the milking process unless the animal has been carefully groomed and the udder washed prior to milking.

3. *Barn Dust.* The atmosphere of the barns is a great potential source of bacterial contamination of milk. Dust should be kept at a minimum at the time of milking by spraying the atmosphere with water or steam.

4. *Personnel.* The most important single source of pathogenic organisms in milk, aside from the cow itself, is the milker. If clothing or hands are dirty, or if he brushes against the cow, dust containing bacteria may be dislodged into the freshly-drawn

milk. The use of modern mechanical milking apparatus has materially reduced this possibility.

5. *Utensils.* If properly cared for, utensils should not add to the bacterial content of milk. Improperly soldered and rusty utensils form extremely good breeding places for micro-organisms and these utensils are often difficult to sterilize properly. All milking vessels should be scalded and preferably boiled, to destroy the bacteria present. In the best dairies all utensils are sterilized in a steam chest before use. The use of the milking machine may prevent contamination from the hands of milker, dust from the skin of the animal, etc., but they are usually complex machines and the tubing may be a source of contamination unless regularly and diligently cleaned.

6. *Water Supply.* Sometimes the water used in washing dairy utensils is impure and consequently a serious source of contamination. Gassy and ropy milk, and typhoid fever may be associated with the use of impure water in washing dairy equipment.

7. *Carelessness.* If milk is allowed to stand in an open can, or unclean dippers are thrust into it, contamination may result.

8. *Milk Bottles and Pasteurization Equipment.* When not properly sterilized, pasteurization equipment and milk containers may be serious sources of bacterial entry.

In view of these factors, it would seem that absolutely pure milk is a physical impossibility. The best that milk-producers can do is to exercise due caution in respect to all known sources of harmful organisms, and then see that further bacterial activity is kept at an absolute minimum. As soon as bacteria gain access to milk they begin to multiply and this can be prevented to some degree by chilling the milk as soon as it is obtained and keeping it cold.

PASTEURIZATION

In order to prevent infection through milk most cities now require that ordinary market milk be pasteurized. *Pasteurized milk* is milk that has been heated for a short time to a temperature high enough to kill all non-spore forming bacteria and yet not high enough to disturb the chemical composition of the milk. After heating, the milk is suddenly cooled to inhibit the growth of remaining bacteria. Pasteurized milk will keep longer than raw milk because of the destruction of certain bacteria which bring about changes in milk.

COMMERCIAL PASTEURIZATION. There are two methods of pasteurization, the *flash* and the *holder* processes. In the flash process, the milk is heated to a temperature of 85 degrees Centigrade and held at that temperature for about one minute. In the holder type, the milk is heated to a temperature of 65 degrees Centigrade and held there for twenty minutes to a half hour. It has been found that the holder method is the more efficient of the two, and if properly employed will kill 99 percent of the bacteria in milk. After pasteurization, the milk should be bottled in sterile bottles and kept at a low temperature, preferably under 10 degrees Centigrade.

Pasteurization in the home may be accomplished by placing the milk in stoppered bottles, heat to 60 degrees Centigrade for twenty minutes and then cool rapidly.

Milk which has undergone pasteurization is not sterile milk and it still may be a source of danger. In recent years some controversy has arisen as to whether or not the process of pasteurization destroys certain important chemical substances in milk and thus renders it lacking in nutritive value. This question is still under discussion. It has been pointed out also that pasteurization may allow an unscrupulous dealer to keep and market dirty milk, which if it had not been pasteurized would have been unfit for use and easily recognized as such.

CLASSIFICATION OF MARKET MILK

The grading of milk differs by states. There is no set national standard. As a rule, however, grading is based upon (1) the health of the cows, (2) the sanitation of the dairy, (3) the chemical composition of the milk, and (4) its bacterial content. The following is the system of grading advised by the American Public Health Association:

GRADE A (RAW). The cows should be free of disease and the employees of the dairy should not be ill, or disease-carriers. The bacteria count should not exceed 10,000 per c.c. at time of delivery.

GRADE A (PASTEURIZED). Cows should be free of disease and the milk handled in such a manner that the bacteria count does not exceed 200,000 per c.c. before pasteurization or 10,000 living bacteria after pasteurization.

GRADE B (PASTEURIZED). Cows should be free of disease and the bacteria count of the milk should not exceed 1,000,000 per c.c. before pasteurization or 50,000 living bacteria after pasteurization.

GRADE C. Milk from healthy cows produced under such conditions that the bacteria count exceeds 1,000,000 per c.c. This milk should be boiled or pasteurized, and should contain less than 50,000 living bacteria per c.c. when delivered. It should be used only for cooking and manufacturing purposes.

CERTIFIED MILK. The term CERTIFIED MILK indicates a milk produced by a dairy regularly inspected by a health board or a committee of physicians. Rigid compliance with certain conditions are necessary for a milk to be Certified. The cows must be free of contagious or infectious diseases; the attendants must be healthy; the stables must be sanitary, well lighted and dust-free; the utensils must be sterile and proper precautions followed to prevent the access of organisms into the collected

milk. After milking, it must be cooled quickly, sealed in sterile bottles, and kept cold until delivery. It must not contain more than 10,000 bacteria per c.c. if raw nor more than 500 per c.c. after pasteurization. Naturally, such milk is more expensive than ordinary market milk.

The requirements for Certified Milk are now the same in all states.

INSPECTED MILK. An inspected milk comes from cows that are tuberculin-tested, and is drawn under sanitary conditions, but the extreme precautions used in certified milk production are not as strictly adhered to. Most of the milk sold in the United States is uninspected and little, if any, sanitary control is maintained over the producer or dealer.

TRANSMISSION OF DISEASE BY MILK

Perhaps the most important of the diseases spread by milk are the various diarrheas and dysenteries of infants. The intestinal tracts of infants seem particularly slow to adapt to the presence of toxins of the paratyphoid and dysentery groups, and a considerable number of cases of the so-called "summer complaint" of infants are due to this fact. It has been shown that in cities which are rigidly enforcing local milk laws, the number of cases of this type and the mortality rate of infants under one year has been materially reduced.

Other diseases associated with impure milk include typhoid, septic sore throat, scarlet fever, bacillary dysentery, undulant fever, and bovine tuberculosis. It is said that at the present time outbreaks of milk-borne typhoid fever are more common than those laid to water as a means of transmission. The typhoid bacillus does not attack animals, thus it must gain access to the milk through careless handling, which would include the use of impure water in cleansing the utensils, or the employment of a person who is a carrier of the disease.

MILK-BORNE EPIDEMICS

Usually a milk-borne epidemic is easily recognized as such. It may be differentiated from one produced by a contaminated water supply by the fact that large numbers of the victims are patrons of a certain dairy. An employee of the dairy may be found to be suffering from the disease, and thus serve as a source for a wide-spread infection. Also, many of the cases are children; whereas in water-borne infections the majority of cases are apt to be adults.

ADULTERATION OF MILK

The adulteration of milk to make it "go further" or to mask unpleasant changes in it, was a common practice until health authorities enacted legislation making such practices unlawful. Some of the more common adulterants which were used include formaldehyde, borax, boric acid, salicylic acid, and water. For many years the unscrupulous dairyman had been "working the pump handle overtime" to stretch the quantity of his product so that "blue milk" or "watered milk" was found in 23.3% of all samples tested by the laboratories of the City of Chicago in 1894. However, in 1925 it had been cut to 0.3% as the result of local milk laws. Today the watering, or other adulteration of milk, is easily detected in the laboratory by the use of the lactometer, creamometer, and various chemical tests.

CHAPTER XXI

Water

Although the ancients were appreciative of the fact that bad drinking water and sickness were oftentimes closely related, they had no true understanding of the factors involved. It has been only in the last generation that all the time, money, and energy expended has brought a true concept of the importance of water to the human body. Today, in truth, water is rapidly gaining its rightful place in body economy and its health-maintaining qualities are being much lauded. Because it is cheap, plentiful, and common-place, people have lost sight of its necessity to the proper functioning of the human body. We have been made "water-conscious" by educational stresses upon the diseases spread by water, rather than upon its life-sustaining properties. Actually, a relatively small number of diseases are spread by impure water. The most important of these are dysentery, typhoid fever, paratyphoid fever, and cholera. Pathogenic bacteria do not live long in water. In most outbreaks of water-borne diseases infections appear within a short period of time, indicating that the cases contacted the same contaminated water within a short time of each other.

Water, or H_2O, is a chemical mixture of hydrogen and oxygen; a tasteless, odorless, clear fluid essential to animal life. It makes up approximately 66% of the total body weight; bathes all tissue cells; carries away wastes of cellular metabolism; excites intestinal peristalsis; enters into the chemical composition of all body tissues from the enamel of the teeth to the brain; is the chief ingredient of all the body fluids such as blood, lymph, cerebro-spinal fluid, etc., and maintains their proper degree of dilution; helps to regulate the body temperature by a process of absorption and evaporation; serves as a distributor of body heat;

prevents friction of mucous and serous membranes by acting as a lubricant; and furnishes in the blood and lymph a medium by which food may be taken to the tissue cells of the body.

AMOUNT NEEDED

Through the process of elimination by way of the skin, intestines, lungs, and kidneys, a large amount of water is constantly being lost. This must be replaced at regular intervals by fluid intake, or through foods containing water. The adult human body needs about 85 to 90 ounces of water each day, 60 to 70 ounces of which should be in the liquid form and the remainder in food. The loss of 1 quart of water from the body which is not replaced will produce the effect of thirst and the loss of 4 quarts without replacement will be dangerous to life.

MINERAL WATERS

Mineral waters are those which hold in solution a relatively high concentration of certain mineral salts which generally make the water less palatable, but nevertheless, they may be advocated for the supposed medicinal properties attributed to their mineral content. They are described as having cathartic, stimulating, alkalizing, or other properties, and the most well known are Vichy, Carlsbad, Saratoga, and White Sulphur Springs waters.

SOFT WATER

Soft water is water holding in solution very little, or no, mineral salts and which readily produces lather with soap. Rain water is soft.

TEMPORARY HARD WATER

Temporary hard water is due to the presence of calcium bicarbonate, or other bicarbonates, which may be split into insoluble carbonate, water, and carbon dioxide by boiling. This makes the water soft.

PERMANENT HARD WATER

Permanent hard water is due to the presence of mineral salts other than alkalies, principally the sulphates and chlorides of calcium and magnesium. These salts will decompose soap to produce an insoluble precipitate and will not lather readily. *Zeolite* is a hydrous silicate consisting mostly of calcium used to soften permanent hard water.

SOURCES OF WATER

Besides the use of water as a beverage, it enters into many domestic activities such as cooking and laundering; and is used in many manufacturing processes. Therefore, its source and the study of its chemical and biological properties is one of the most important phases of modern hygiene. All natural waters contain some micro-organisms of one type or another.

Under the influence of sunlight, sea water evaporates and forms water vapor which is called clouds. These, driven by air currents and winds, pass over land and are precipitated as rain, snow, or hail. Much of this vast amount of precipitation collects into creeks, rivers, lakes, or subterranean areas and may eventually reach the sea from whence it came.

Clouds are free from organisms but when precipitation occurs, micro-organisms from the air and the soil find their way into it. Some of these find in water sufficient food and satisfactory environmental circumstances to thrive and accordingly they are called the "water flora." Others, such as soil bacteria, are found only at certain seasons, as after a flood, and they flourish for only a short time. Intestinal bacteria are also short-lived in water.

There are three main sources of water:

1. *Rain water.* Rain water as it falls is pure, but not particularly palatable until it has been aerated, due to the lack of certain gases and minerals which enhance its taste. It is usually collected in cisterns and tanks and is a soft water, good for cooking and laundering purposes.

2. *Surface water.* Surface water is that derived from lakes, rivers, and streams. Water from rivers and streams cannot be considered safe due to community and industrial pollution.

Water from lakes may form a good supply provided it is gathered from the center. The action of the sun and oxygen purifies the water far from shore. Shore water is never safe. The big problem in using a lake as a source of community water supply is to get water not polluted by the sewage of the city, which, in some instances, may be accomplished by placing the intake far out into the lake.

3. *Sub-soil or ground water.* Sub-soil or ground water comes from springs, wells, or tube borings.

(a) Spring water is of two kinds, land and main springs. A land spring is formed by water that bubbles through the ground and appears at lower levels, and thus may be heavily polluted en route.

A main spring is formed by water from an underground reservoir lying between two strata of rock, which being impermeable, force the water to filter upwards through a considerable depth of soil. Such water is relatively safe for human consumption.

(b) Deep wells, or those more than 30 feet deep, are usually a reliable and satisfactory source of water supply, although of necessity, a limited one.

Shallow wells are of doubtful purity because they may drain much surface water, or, being located in the vicinity of barnyards or privies draining into porous soil, may be heavily contaminated. To be safe, well water should first filter through a closely packed strata of earth or rock. The well should be lined with cement or similar material so as to exclude surface drainage, covered so as to prevent surface contamination, and equipped with pumps so that no object from the outside, such as a pail, needs to be introduced.

(c) Artesian water obtained by tube borings is usually safe.

It comes from underground supplies, formed by waters draining from higher points beneath impermeable strata.

(d) Distilled water is bacteriologically pure, but is not palatable. It is economically unsound as a source for large scale use.

METHODS OF WATER PURIFICATION

There are two principal methods of water purification, namely, natural and artificial.

NATURAL METHODS

1. *Sunlight.* Although the germicidal effect of sunlight is well known, it has but a limited action against bacteria in water. Its greatest potency is exhibited in slow-moving, clear, shallow water. Tests have shown that the germicidal action of sunlight is lost after a depth of 9.5 feet has been reached.

2. *Temperature.* From a general standpoint, a low temperature in water tends to inhibit or retard the growth of microorganisms.

3. *Oxidation.* Tidal rivers, waterfalls, rapids, and the surface of water may absorb a considerable amount of oxygen which destroys many organisms.

4. *Food supply.* Bacteria are dependent upon a sufficient supply of food for their continued existence, thus the amount of organic matter in water directly influences their growth. Where a large amount of organic matter is present, the number of organisms also is large. The lack of food or food not of the proper quantity or quality is given as a major reason for the so-called self-purification of streams.

5. *Dilution.* A heavily polluted body of water may enter a relatively pure quantity of water with the result that the former is purified by dilution at the expense of the latter. This is seen in the case of sewage flowing into a river or lake with a resultant decrease in the amount of available food material, and in the number of organisms in relation to the volume of water.

6. *Sedimentation.* The organisms present in impure water tend to settle to the bottom, or undergo sedimentation. This is partly due to the phenomenon of adhesion in which bacteria tend to form clumps or attach themselves to solid particles in the water and settle to the bottom where unfavorable conditions may cause their death.

7. *Filtration.* The water of any flowing stream undergoes a certain amount of filtration when it passes over sandy soil. Plants and algae present in water tend to catch and hold bacteria and assist in the filtration process.

8. *Antibiosis.* When water is highly polluted the putrefactive and non-pathogenic bacteria develop so rapidly that they outnumber and destroy the so-called pathogenic forms. Also, many forms of protozoa may be present which consume bacteria as food.

ARTIFICIAL METHODS

1. *Distillation.* This is a sure method of obtaining pure water, but is completely impractical for any large volume consumption.

2. *Boiling.* Boiling sterilizes water and can be used on a small scale but is not practical on a large scale. Boiling gives a flat, insipid taste to water, due to the gases being driven out. Taste is improved by cooling and shaking.

3. *Iodine.* Iodine may be used for water purification wherever a limited amount is required. Ten cubic centimeters of tincture of iodine is added to about 35 gallons of water and the mixture is allowed to stand for 30 minutes. This is a reliable method, and can be used when the immediate need of the individual is small.

4. *Sedimentation and filtration.* In the more populated areas of the country, the problem of obtaining a satisfactory water supply becomes more difficult, as well as more pressing. There are few towns or cities fortunate enough to obtain their water

supply from an unpolluted source and it becomes necessary to process the water first before it is fit for human consumption. The processing of water by sedimentation and filtration has been common for almost a century and it still is the most widely used of all large-scale artificial purification methods.

The first step of sedimentation is accomplished by the use of large impounding reservoirs in which the water is held for a period of time to allow the natural methods of purification to act, but mainly to permit proper sedimentation. This process may be speeded up by adding to the water certain coagulative substances such as ammonium aluminum sulphate, or a mixture of ferrous sulphate and lime. The water is then run over the filters which are called sand filters. These may be of two types: *slow and fast.*

Filtration by the slow sand filter depends upon the formation on the sandbed surface of a slimy, gelatinous mass which is composed for the most part of bacteria and their metabolic products. Through the action of enzymes, oxidation, and the devouring of bacteria by the tremendous numbers of protozoa present in the filtering mass, the water trickling down through the layers of sand and rock is bacterially pure when it finally reaches the bottom of the filter. It is carried away by underground drains to cisterns where it may receive a dose of chlorine. The upper layer of the filter must be cleaned occasionally by removal of the gelatinous mass, or by blowing masses of air up through the filter which disturbs the bacterial flora on the top of the sand. The slow sand filter is a very efficient purifying agent, but has the disadvantage of being expensive to operate, due to the large area of filter bed necessary to produce a reasonable amount of water. The rate of filtration is controlled at about 4 inches per hour. After cleaning the filter, it takes some time until an efficient new layer of scum is built up to replace the one disturbed or destroyed. About seven days may be required to regain maximum efficiency.

Filtration by the rapid sand filter is chemical and physical in principle, rather than biological. The incoming water is dosed with a chemical such as ammonium aluminum sulphate, which will form a coagulum with the alkali in the water. About half of the coagulum and its entrapped bacteria settle out in specially constructed basins and the remainder is removed in the rapid sand filter. This consists mainly of layers of fine sand where the water is allowed to settle and filter through. After a few days of use, the sand is washed by forcing air and water up from the lower part of the filter and it is again ready for use. The rapid sand filter gives a very good removal of bacteria and it also removes color and inorganic suspended matter. It can be operated at high speed, giving about 125 million gallons of water per day for each acre of filtration bed. Because they require less filter surface, remove coloring matter, and produce water quickly in a reasonably pure state, they are the most common filters in use for large water supplies.

After filtration the water is treated with chlorine and stored in underground or covered cisterns.

5. *Ozone purification.* It is well known that ozone has definite antiseptic properties and, accordingly, it is used in some towns, particularly in France. The ozone is produced by means of the electric current. A flowing film of water is brought into contact with an upward current of air containing ozone, a contact which makes the water almost sterile. It is efficient, but expensive.

6. *Porous filters.* Filters made of unglazed porcelain, or baked diatomaceous earth, are frequently used in the home and the laboratory. The porcelain filters are known as Chamberland filters and the diatomaceous earth filters are called Berkefeld filters. These may fit directly to the water faucet. They are efficient in their first period of use, but gradually collect large numbers of organisms in the filter pores and may actually contaminate water rather than purify it. This is overcome by frequent cleaning, and by baking the filter to a red heat.

One disadvantage, besides the contamination, is the need for considerable pressure to pass water through them. They are practical only where small amounts of water are needed.

CHLORINATION

The filtration of water is an almost perfect means of water purification but an added protection is usually sought by means of chemical disinfection. Chemical purification employs chlorine and its compounds. About 50 per cent of the daily consumption of water in the United States is chlorinated water; this is roughly 4 billion gallons per day. The amount of chlorine added varies from 0.15 parts chlorine to each million gallons of water, to 0.7 parts, and in these concentrations, chlorine is harmless because it decomposes rapidly and by the time chlorinated water is consumed, it has lost its disagreeable odor and taste. If the odor and taste of chlorine persist, it is usually due to the presence of chlorinated phenols derived from certain manufacturing wastes which may have been present in the original supply.

The most common application of chlorine to water is by means of the automatic dosage chamber, or chlorinator, which treats the water with liquid chlorine after the proper dosage has been determined. Liquid chlorine is the most satisfactory form of chlorine for municipal purification, but some cities may use bleaching powder and a few use the electrolytic bleach (sodium hypochlorite). Occasionally, a mixture of hypochlorite and ammonia is employed because the presence of ammonia lessens the amount of chlorine needed.

REMOVAL OF ODORS AND TASTES FROM DRINKING WATER

The presence of odors and tastes may render a water disagreeable, but they are harmless. Sometimes a city supply may contain an objectionable odor or taste; or large quantities of iron or sulphur or other minerals may be present. Also, the water may be highly colored, lessening its attractiveness but not its purity.

Odors in water are usually due to the growth of certain organisms, particularly if the water has been held in a reservoir. These organisms may be low plant forms such as the algae, or low animal forms such as protozoa, and each species may produce a characteristic odor. For example, volvox gives a fishy smell to water, anabaena a grassy odor, asterionella a geranium odor, and synura a cucumber taste.

These undesirable odoriferous organisms may be kept down by three different methods. The most common is the addition of copper sulphate employed in the ratio of one to four pounds per million gallons of water. Aeration, and chlorination are the other two methods and they also act efficiently.

WATER-BORNE DISEASES

A pure water may be defined as one which contains no disease-producing organisms of any kind and a minimum of organic matter with accompanying putrefactive bacteria.

An impure water is one which may contain sewage, and is not fit for human consumption because of the possible presence of pathogenic bacteria.

The most important of the diseases associated with impure water are bacillary dysentery, amebic dysentery, typhoid fever, paratyphoid fever, and cholera.

Since the organisms of these diseases are associated with discharges from the intestinal tracts, and do not live long outside of the body, their presence in water is indicative of recent sewage contamination.

SANITATION OF SWIMMING POOLS

Swimming pools are potential sources of such diseases as middle ear infections, conjunctivitis, skin diseases, intestinal diseases, and others. They should be protected to the same high degree as a public water supply, mainly by exercising caution in regard to the people using the pool. Each person should be re-

quired to use a soap shower bath before entering the pool and no person who has an infection should be granted pool privileges. The water should be changed frequently, and be subjected to frequent disinfection by the use of chlorine. A high concentration of chlorine of about 0.5 parts per million parts of water is good and is only slightly irritating to the eyes. Added precautions include the use of sterilized suits and towels by the bathers, and the use of a foot-tub containing a proper disinfectant to prevent the spread of athlete's foot.

CHAPTER XXII

Sewage

Sewage is made up of the miscellaneous and varied wastes of human life and activity. It includes personal, community and commercial wastes.

The sewage of any community may become a serious menace to public health if not disposed of properly. As cities and communities increase in size and congestion, sewage disposal poses a more serious problem of public health. Care must be used in its disposal for two reasons: first, it may pollute water supplies; second, it may stand in pools and produce noxious odors and thus become a nuisance. Small towns situated on streams below larger cities which dispose of their sewage by emptying it directly into the stream may be subject to sewage-borne diseases. Thus it is evident that cities upstream must make provisions against untreated sewage entering the stream.

METHODS OF SEWAGE DISPOSAL

The easiest method of sewage disposal is to allow the sewage to flow into a stream or river where sufficient dilution may occur so as to eliminate a possible nuisance. Or, the sewage may be allowed to escape directly into the ocean where it is washed away, or into a large lake where extensive dilution is possible. Obviously these methods are attended by possible dangers to adjacent populations, so that by far the most satisfactory procedure is to treat the sewage before its final disposal. There are many methods of sewage treatment but all, more or less, are based upon certain fundamental plans:

1. *Screening:* to remove very large objects which cannot be removed by biological action: these include glass, wooden cases, paper, cloth and similar waste.

2. *Sedimentation:* by the use of such chemicals as alum, lime, sulphate of iron, or some similar coagulant, which along with the precipitating factor of gravity, remove the smaller particles. The sewage is collected in large vats for this process.

3. *Biologic decomposition of organic material:* in which the sewage is subjected to the activities of certain anaerobic bacteria which have the power to break down proteins, split fats, ferment sugars, and digest cellulose. Protozoa also assist in this chemical destruction.

4. *Disposal of the fluid:* after treating with chlorine the fluid is allowed to drain into properly designated areas.

5. *Disposal of the treated solids:* these are usually compressed and incinerated, or may be used for fertilizer as they have high nitrogen availability.

SEPTIC TANKS

Septic tanks are closed chambers or cisterns into which sewage is allowed to flow after it has undergone screening and sedimentation. A septic tank actually is a large, self contained, biochemical laboratory utilizing the well known powers of certain bacterial groups to act upon organic matter. It is usually of sufficient size so that 12 to 24 hours are required for any given part of the sewage to pass completely through. Aerobic bacteria quickly use up the incoming oxygen and thus the tank is essentially anaerobic in its action and the anaerobic and putrefactive bacteria bring about a rapid decomposition of the solid organic materials.

The flow of the sewage must be properly controlled so as to prevent this bacterial activity from producing malodorous compounds which result from too long an exposure time. The bottom of the tank contains the bacterial flora, and the eddies and currents in the tank constantly swirl these upwards to re-inoculate the incoming material and fluid above.

After leaving the septic tank the clear fluid may be allowed to flow directly into a stream or it may undergo chlorination first and then disposal. The reason for this is because a septic tank does not materially decrease the number of organisms present in the original sewage; it only breaks down organic matter and makes it more soluble. There are several different courses followed in further purifying the fluid after it leaves the septic tank. These are:

1. *The sand filter,* in which the fluid is allowed to flow over a sand filter very similar in construction, and with essentially the same principle of purification, as found in the slow sand filter used in water purification. Oxidation is rapid in this type of filter. By this filter, 99% of the bacteria are removed.
2. *Contact beds* are modified types of sand filters consisting of beds filled with crushed rock, cinders or coke, instead of sand. The contact operates rapidly and the fluid remains in contact with the bed for only a short time but long enough to permit complete aeration.
3. *The trickling filter,* in which the fluid is sprayed intermittently onto the surface of ā contact bed or sand filter and the dissolved organic matter is oxidized by aeration. This oxidation is so complete that no disagreeable odors will result from disposal of the treated sewage into streams.

SEWAGE FARMS

Some of the larger cities of the western coast of the United States, and certain European cities, dispose of their sewage by means of sewage farms. This method may be employed where large areas of sandy soil are available and where the climate is dry. It is not practical in clay soils or in a damp climate. The sewage is spread out over the land as in irrigation, and the excess is drained off by underground tiles. Grains and hay are the principal crops of such farms rather than foods for human consump-

3 types of waste elimination
1. Seperate
2 Storm.
3 Combined.

tion. The organic material is completely oxidized in passage through the soil and the water draining through the underground tiles is relatively pure, at least sufficiently so that it may be disposed of by emptying into streams.

THE IMHOFF TANK

Probably the most popular means of sewage disposal in use in the United States today because of its efficiency of disposal for small communities. However, due to a limited capacity it is not employed to any extent in large urban areas. The tank is usually a rectangular structure divided into an upper and lower chamber. The upper chamber serves as a sedimentation tank for the incoming fresh sewage and its floor is made up of slots which permit the eventual passage of the sewage into the lower chamber. Here, the sewage undergoes decomposition. As a large amount of gas is formed in the bottom level the solid fluid is buoyed up by the gas and passes into separate gas vents. The sludge in the lower part of the tank may be retained for a long period of time while it undergoes decomposition to the point where it may be run off into drying beds and disposed of from there.

THE ACTIVATED SLUDGE TREATMENT

Is a method of treating the sludge left after sewage has undergone the primary steps of sedimentation and digestion. This residue or sludge is activated by passing compressed air blasts through it. Thus, the sludge particles are kept in constant motion and an oxidizing process is maintained which decomposes the suspended solids in a short period of time. The activated sludge when run through an efficient activator may be used for commercial fertilizer. However, this process is not without certain drawbacks principal among them being, (1) the mechanical equipment is expensive to maintain, (2) the process may be

easily disturbed by the introduction of unusual wastes such as large amount of fats. The advantages claimed for the activated sludge treatment are (1) a plant may be small and installed cheaply by comparison with other methods, (2) a high degree of purification is obtained when properly controlled, (3) a pumping station may not be required because the pressure of the incoming sewage is usually sufficient to force the sludge through.

disease is transmitted to man by sewage
Typhoid fever
Cholera
Bacillary an amebic Dysentary
Hepatitis
Trichonosis or Hook worm.

chemical, physical, bacterial, Mechinal.

Preserve natural Resource

2 Types waste material
liquid - animal & man.
washing kitchen waste.

Solid Garbage ashes and rubbish
Incineration the destruction of Garbage by burning 1800 - 2000°F.

CHAPTER XXIII

Industrial Hygiene

Industrial hygiene is concerned with establishing in industry those conditions which will stop accidents, provide a healthful working environment, and generally safeguard the worker. The importance of good hygiene in occupational surroundings becomes obvious when we stop to consider that the average man spends some eight hours each day for a period of some thirty or forty years at his work, and if unhygienic circumstances exist during this time, his life and health may be greatly jeopardized. Probably no single factor has such a far-reaching effect upon public health as does industrial hygiene because the social and economic systems of the country are dependent upon the health and efficiency of its members. If a man is sick and unable to carry his full responsibilities, in society as well as in occupation, then society suffers from his loss. Of course, reversely, the personal hygiene of the individual may influence his occupation, as witness the hypothetical case of an airline pilot who might start his run while under the influence of alcohol.

The prevention of accidents has become a major objective in most industries since various fact-finding groups have pointed out the tremendous loss in life, limb, and money due to accidents which for the most part were avoidable. Large organizations employ specialists in accident prevention, called safety engineers, whose job is to ferret out such activities or circumstances as may be dangerous to the worker. They are best known for their recommendations regulating the wearing of goggles by those engaged in work which might injure the eyes, or the wearing of steel safety shoes when heavy objects are being handled. So wide has become the scope of the safety engineer that traffic rules and other regulations for the maintenance of public safety are oftentimes promulgated by them.

In its strict sense, however, industrial hygiene is concerned with the promotion of healthful working conditions. It seeks to promote ideal conditions of ventilation, space, temperature, and similar measures; as well as dealing with certain poisons formed by, or used, during the occupational pursuit.

CONTROL OF INDUSTRIAL POISONS

There are two methods by which the prevention of industrial poisons may be prevented. One is the control of the work itself, and the other is protection of the individual.

The portals of entry of the various industrial poisons pose the problem as how best to deal with them at their source. In ordinary poisons we find them to be active through ingestion, inhalation, and inunction. Industrially the great majority of poisonous substances gain entrance to the human body by inhalation.

1. *INHALATION* is the conveyance of poisons through the air in the form of toxic gases and dust and fumes. These substances when inhaled may produce a local effect upon the upper respiratory tract, as do caustic soda and hydrochloric acid, or they may reach the alveoli of the lungs and enter the blood-stream to produce a systemic effect, as is true of zinc oxide. Some of the toxic matter may be caught by the saliva and enter the gastro-intestinal tract to further complicate the condition. This explains why those poisons found in a gaseous or fume state are much more apt to produce an acute attack of poisoning than those which enter via the digestive system where the body may render most of the toxic material insoluble. For example, lead poisoning rarely occurs as an acute manifestation when it has been consistently swallowed but it is common for acute lead poisoning to appear in those individuals who have been inhaling lead fumes for some period of time.

2. *SKIN CONTACT*. This represents the second most important portal through which industrial poisons may enter the

body. Certain toxic substances gain entrance to the tissues and bloodstream of the body either by coming in contact with the skin directly, soaking into the clothing, or being sprinkled in powder form upon a moist skin which acts to form a toxic poultice. Some of the most common of these poisons include the coal tar derivatives, dyes, phenol, mercury, carbon disulphide, and tetraethyl lead. The latter is now extensively used in gasoline as an anti-knock compound and it is particularly dangerous in that it is highly soluble in body fat and is absorbed readily through the subcutaneous adipose tissue directly into such vital centers as the liver or the brain. This is the reason why the U. S. Public Health Service insists that all pumps dispensing ethyl gasoline be so labelled with a warning attached concerning the danger of fumes and spilling upon the skin.

3. *INGESTION.* This means of entry is the least important but the most avoidable of the three portals of entry, since it usually represents carelessness or ignorance on the part of the worker. It is brought about by eating foods while the hands are contaminated with the poisonous material, or putting objects into the mouth which are poisonous. An individual working in a plant manufacturing insecticides may have hands contaminated with arsenic and when eating lunch with unclean hands a certain amount of the arsenic is apt to be swallowed; or a commercial retoucher in a photographic studio may moisten the tip of the brush with his tongue and then apply it to a white lead paint and repeat this process many times during the day with eventual slowly developing symptoms of lead poisoning.

As a general statement it may safely be said that all forms of industrial poisons gain access to the body by way of the three routes mentioned above, but by far the most important form of poisoning is due to those which appear in the form of a gas or dust. For purposes of classification, industrial dusts may be considered according to their properties:

1. *MINERAL DUSTS* are most commonly found in such trades as cement, stone and marble work, coal mining, diamond cutting, moulding, core-making, plastering, and sand-blasting. These dusts are oftentimes associated with a pulmonary disease called "dust-disease" or SILICOSIS.

a. SILICOSIS is a pulmonary disease resulting from the inhalation of certain mineral dusts, particularly silica, which is expressed clinically by dyspnea, decreased chest expansion, absence of fever, and an increased susceptibility to tuberculosis. The production of silicosis is dependent upon the amount of dust, the length of exposure time, and the amount of silica present. The best treatment for silicosis is its prevention, which may be accomplished by using fans, exhaust pumps, filters, and masks. A change of occupation may be necessary in some cases. In most states compensation to persons afflicated with silicosis is a legal requirement.

b. ANTHRACOSIS is also called *"miner's lung"* and pneumonoconiosis. It is a lung disease produced by inhaled coal dust. The symptoms and the prevention of anthracosis are essentially the same as for silicosis.

2. *METALLIC DUSTS* are commonly associated with certain trades such as tool and die making, grinding, polishing, brass works, printing, painting, and other metal work. Probably, this represents the greatest single type of industrial poisoning because of the wide variety of substances employed in industries which are possible sources of poisoning. The most common metallic poisons are lead, arsenic, mercury, brass, and copper.

a. LEAD POISONING, also called *plumbism,* or *saturnism,* is the most common form of metallic poisoning and may be found industrially in more than 150 different occupations such as plumbing, painting, glazing, rubber vulcanizing, zinc smelting, manufacture of storage batteries, and myriads of other lead industries. The condition is usually a chronic one and presents rather characteristic symptoms, namely: a greyish pallor of the

skin with a pinched expression to the face, anorexia, indigestion, and occasional attacks of colic, (painter's colic), motor disturbances in the form of a palsy and later a paralysis (as in the common wrist-drop), a blue line around the gums, and in the more severe cases blindness, convulsions, coma, and death.

b. MERCURIAL POISONING—or *mercurialism* is the result of employment in such industries as manufacture pharmaceutical supplies, barometers, thermometers, incandescent lamps, felts, and fur processing. As in the case of lead poisoning, it is the cumulative effect which produces the symptoms. The presence of a strong metallic taste in the mouth, a fetid breath, ulceration of the gums, loosening of the teeth, excessive salivation, abdominal cramps, and decreased kidney function are early signs of the disorder. Paralysis of the extremities is not uncommon in the later stages. Since mercury is most easily absorbed into the system when in the form of fumes, workers should be protected against breathing such impurities.

c. ARSENIC POISONING is encountered in the manufacture of dyes, disinfectants, insecticides, drugs, paints, wall-paper, electrotyping solution, and in taxidermy. One of the first signs to show is that of hyperpigmentation appearing in a "rain-drop" pattern on the palms of the hands and soles of the feet. It also affects the upper respiratory tract in the beginning stage and simulates a catarrhal inflammation. As the poisoning progresses it may produce a generalized neuritis and degeneration in the liver and kidneys. It is not uncommon to find labial and nasal ulcers.

d. PHOSPHOROUS POISONING occurs most frequently in the manufacture of matches or the painting of luminous dials on clocks and other instruments. Phosphorus is not found in the free state chemically but is combined with alkalies in two different forms; the yellow, crystalline, waxy form which is highly poisonous, and the reddish-brown, non-poisonous powder. The fumes of phosphorus may produce a necrosis of the upper and lower

jaw bones, particularly in persons with dental cavities. Such workers may prevent necrosis by proper dental hygiene and the regular use of an alkaline mouth wash such as lime water or sodium bicarbonate. The best preventive of course, is the installation of proper ventilation to carry off the fumes, and instructions to the workers of the dangers involved in placing contaminated objects or fingers near the face or mouth.

e. BRASS POISONING is due to the inhalation of fumes of zinc and zinc oxide. It is commonly called "brass-workers ague" because of the chills associated with the poisoning process. The fumes of zinc oxide are not poisonous in themselves but the finely divided powder spreads over the inner lining of the alveoli of the lungs and because of its hygroscopic power it kills the lining cells. It is the resorption of these dead cells which produces chills and fever characteristic of "brass workers" or "brass-founders ague."

f. CHROMIUM POISONING. Chromium compounds are used largely in the manufacture of batteries, dyes, and furniture stains, and in chromium plating. The salts of chromium may form tiny particles and float in the air to be inhaled with subsequent formation of ulcers in the nasal and respiratory tract. A metallic taste in the mouth and gastro-intestinal upsets are symptomatic.

g. CARBON MONOXIDE POISONING is insidious because the poison is odorless, tasteless, and colorless and gives no warning of its presence. It is a by-product in the exhaust of any gasoline motor, is found in illuminating-gas, and produced by the incomplete combustion of coal. It may be present to a greater or lesser degree in steel mills. When inhaled in sufficient amounts it produces an acute attack of carbon monoxide poisoning with its symptoms of nausea, vertigo and dyspnea, with possible complete respiratory collapse. If present in the air day after day it may produce a chronic sense of fatigue along with head-

aches, upset stomach, nausea, and nervous system involvements such as tics and paralysis.

h. CARBON-TETRACHLORIDE POISONING. This chemical compound is widely used in certain industries as a fat and rubber solvent, type-cleaner, vermifuge and stain remover, and in the manufacture of fire extinguishers. Inhalation of carbon-tetrachloride fumes may produce a conjunctivitis, nasopharyngitis, and digestive disorders.

Although carbon monoxide and carbon tetrachloride poisoning are not metallic poisons they are sufficiently closely related to industries dealing with metals to warrant their inclusion in this group of industrial poisons.

3. *ANIMAL DUSTS* are commonly present in the air breathed by taxidermists, furriers, and carpet workers, upholsterers, slaughter-house workers, and felt manufacturers. Animal dusts in themselves are not generally toxic. They produce allergies in some workers, but their continued inhalation may set up a chronic respiratory irritation which lowers resistance against pulmonary disorders such as tuberculosis.

4. *VEGETABLE FIBER DUSTS* are encountered in the manufacture of paper, cloth, furniture, and clothing. They are similar in action to animal dusts in that they predispose towards more serious pulmonary diseases when inhaled over a period of time.

PROTECTION OF THE INDIVIDUAL WORKER

The presence of poisons in certain industries makes it vital that proper measures be taken to safeguard as far as possible the health of workers engaged in them. This procedure rightly belongs to the industrial hygienist who is something of a chemist, engineer, toxicologist, and psychologist. Responsible companies are becoming increasingly aware of the health problems of their employees and are rapidly establishing ways and means of em-

ployee-protection. It is obvious that the efficiency of an organization is directly proportional to the health record of its personnel. The industrial hygienist bases his protective measures on the characteristics of the hazard and its mode of attack.

a. *Regular health examinations.* When workers are known to be exposed to poisons it is advisable that they be examined at regular intervals, the frequency of which will depend upon the severity of exposure, or signs of declining health. In the case of miners and other workers exposed to mineral dusts this would include chest x-rays, and in workers with lead it would include tests for increased lead absorption. Many other tests can be made to detect developing or incipient illnesses, and to check the effectiveness of recommended protective measures.

b. *Study of the working environment.* This study includes the use of apparatus specially designed to measure the amount of poisonous material present in the environment of the worker. For example, if analysis shows the air of a mine contains too high a concentration of silica dust the official may recommend that proper ventilating systems be installed or that wet drilling be instituted. Perhaps the use of respirator masks may be suggested. This phase of industrial hygiene deals with all types of poisonous formations and the most efficient means of eliminating them, or of protecting the worker against their effects.

c. *Special protective equipment.* In many occupations it has been possible to materially reduce the working hazards by supplying equipment designed to nullify the harmful effects of the work, or to prescribe certain procedure to neutralize harmful reactions. Skin absorption of toxic matter has long been recognized as a cause of industrial poisoning. It is guarded against by the use of impervious gloves, aprons, and boots, along with adequate ventilation. Trinitrotoluene plants engaged in loading shells during the war found that such dust, particularly during hot weather caused poisoning when contacting sweaty skin. It was dealt with successfully by reducing the atmospheric con-

tent of dust to a minimum and the provision of full suits of washable clothing along with impervious gloves and footwear. In those industries using large quantities of arsenic, as copper smelting, the worker may be protected by covering the face with some bland ointment and packing the ears and nasal passages lightly with absorbent cotton. In some cases when exposed to a high concentration of fumes or irritating dust the worker's head may be completely covered with a helmet and air hose, to doubly protect against skin irritation and inhalation. The disadvantage to this method in prolonged exposure is that the worker usually dislikes to drag an air-line around behind him. However, respirators and filter masks may be worn instead. Army gas masks of the cannister type are good for emergency exposures to such poisonous fumes as carbon monoxide in steel mills, or ammonia in refrigerating plants, or nitrous fumes in the manufacture of nitric acid. The eyes of steel workers have been protected from the glare of furnaces by the use of goggles capable of resisting infra-red and ultra-violet rays without seriously impairing visibility. In machine shops the cutting oils used are often the source of infection for boils and skin irritations and this has been successfully combated by occasional sterilization of the oil, and the use of clean paper towels instead of ordinary waste or towels, so that small steel particles may not enter the skin when the hands are wiped.

d. *Safety equipment.* Intelligent industrial management is constantly on the alert to improve its safety record by the reduction of factors which lead to accidents. Safety engineers are employed to design machines safe enough for even the careless workman. This practice includes the use of guards around machinery, as well as recommendations for the wearing of such protective clothing as steel-toed shoes, and shatterproof glasses.

e. *Rotation of workers.* This has been an effective measure in that it shortens the exposure time per individual to more haz-

ardous types of work and prevents the building-up of careless habits.

f. *Health and safety instructions.* Periodic meetings to discuss health problems by all personnel of an organization has been proved to be an efficient method of inaugurating beneficial health and safety procedures. Many times a worker will bring forth an important observation which will materially reduce the illness or accident rate of his fellow employees. This method also does much to instruct new workers in the care and conduct of themselves in order to overcome the hazards of their new occupation.

g. *Pre-employment physical examinations.* A complete physical examination of an applicant for a job may do much to eliminate the hiring of workers whose presence on the job may be detrimental to the welfare of their associates, as well as to themselves. For example, a man in good health, but whose vision is below normal, would certainly be a poor employment risk as a locomotive engineer. In the same light a person moderately overweight should not work under high atmospheric pressures, as in tunneling under the ground. The race of the individual may have a bearing upon his susceptibility to toxic substances, as shown in the fact that Negroes are much more resistant to those poisons which affect the skin than are white people, but in turn are more apt to suffer from the effects of inhaled dusts, particularly lead.

h. *Heat and humidity control.* The presence of prolonged high temperatures and humidity add greatly to the dangers of absorption of poisons through the skin. The devitalizing effect of working under such atmospheric conditions lowers the individual's toxin-resistant powers, as well as inducing early fatigue with its attendant carelessness.

WOMEN IN INDUSTRY

Due to the tremendous demand for industrial workers during World War II many women were engaged in industries formerly

considered as being reserved wholly for the male worker. Many of these women workers were retained. Women present health problems not encounterd among male employees. Statistics show that illness is of higher prevalency among women than among men engaged in the same industries. Absenteeism is also higher. Industrial hygienists ascribe these figures to four factors.

1. *Responsibilities other than the occupation.* It is true that many woman workers must maintain a home in addition to their occupational duties. Such work as cooking, house-cleaning, washing, and other activities may seriously fatigue them to the point of endangering their health.

2. *Pregnancy.* Most women workers fall into the child-bearing group. No women in the last three months of pregnancy, or who are breast-feeding their children should be allowed to work.

3. *Menstruation.* Certain types of work may tend to produce such menstrual disorders as dysmenorrhea or menorrhagia. This may be due to prolonged sitting, standing, or walking; or such occupations as would cause vibrations affecting the pelvis or abdomen. Occupations especially fatigue-producing, or those requiring exposure to inclement weather may also tend to bring on menstrual disorders.

4. *Proper eating habits.* Women are notoriously lax about eating proper foods in the right amount, mainly due to their attempt to maintain a desired weight and figure. It is essential that eating habits conform to demands upon strength, especially of women engaged in heavy industry.

FATIGUE AND INDUSTRIAL HYGIENE

Fatigue results when waste products such as lactic acid are not removed from the blood, but are carried throughout the system with a subsequent lowering of general body efficiency. Long continued activity of even moderate proportions or intensity will result in the exhaustion of the nerve cells conveying mental im-

pulses to the muscles, or a decreased response of the muscle cells themselves. Workers who are fatigued become careless and make mistakes they would not make if they were free from fatigue. Industrial hygienists recognize the fact that a sudden increase in the number of accidents in a job formerly considered not particularly hazardous may have its cause in excess fatigue. Not only is this true of manual workers, but also of "white collar" employees, among whom mental fatigue from prolonged mental exertion may bring about an increased illness rate. The answer to fatigue might take the form of short vacations, or temporary removal from excessive responsibilities which may be diverted to others. Both labor and management have been working towards the reduction of fatigue and its accompanying waste of materials and time by setting up wage-hour regulatory laws and other plans designed to exact maximum production from a worker without jeopardy to his own, or his fellow workers' health. Frequent rest-periods, adequate recreation, periodic physical examinations, and the creation of fatigue-resisting environmental surroundings have done much to combat this problem of industry.

A *fatigue neurosis* or a *fatigue disease* is one resulting from the prolonged use of a specific set of muscles, as is found among telegraphers or typists in which the muscles of the fore-arms and fingers may undergo paralysis due to excess local fatigue. Scientifically spaced rest-periods may do much to prevent the onset of such a condition.

The place of personal hygiene in regard to fatigue must not be overlooked. If a person is suffering from a subluxation and this condition is manifesting itself by distinct signs, either physical or mental, the individual is already laboring under an added load. Any interference with the transmission of mental impulses is bound to drain vitality to a greater or lesser degree. If this vertebral subluxation manifests itself merely as a cervical tension and dullness of the mind it necessarily follows that such a person

is going to tire more easily than if he were free of such encumbrances. Prevention of this state of affairs would be dependent upon adjustment of the subluxated vertebra and restoration of normal function so that worker could utilize all his energies rather than a part of them. Also, proper rest and proper food and other incidentals of personal well-being are inexorably part of the anti-fatigue routine.

Habitual use of alcohol is certainly going to predispose the worker towards fatigue. Accordingly, the prevention of fatigue is a two-fold project dependent upon the cooperation of the individual in his personal habits, and industry in its intelligent anti-fatigue provisions.

Since the subject of industrial hygiene is one of many details and ramifications this chapter must of necessity be confined only to the more salient features of the health problems of industry. The following brief outline is presented to help the student in retaining easily the more pertinent factors of industrial hygiene as a whole and to correlate them with such detailed explanations as have already been discussed. The mental as well as the physical health of the worker may be influenced by these aspects of the subject.

A. Personal health factors to be considered in choosing an occupation.

1. The nature of the work.

a. Strenuous or mild muscular work, or sedentary in type.

b. Outdoor work or indoor work.

c. Dusty occupations (flour milling, stone cutting, mining).

d. Chemical occupations (poisonous fumes, gases, etc.).

e. Healthful ventilation.

f. Proper lighting.

g. Healthful temperatures.

2. Educational opportunities; whether or not adequate libraries, churches, and similar public institutions are accessible. This would also include schools for the worker's children.

3. Recreational facilities.

a. Hours of labor, vacation periods.

b. Healthful recreation facilities available (golf courses, swimming pools, public parks, theatres, etc.).

4. Type of community in which industry is located.

a. Rural (farming, small industries, small businesses, etc.).

b. Urban (large manufacturing plants, commercial and industrial centers, etc.).

B. Industrial health factors to be considered in choosing an occupation.

1. The nature of the work.

a. Dusty occupations (mining, flour mills, quarrying, etc.).

b. Steel manufacturing (foul gases, high temperatures, accidents).

c. Mining (hard work, poorly ventilated, accidents, dark and damp, etc.).

d. Chemical industries (exposure to poisons, dangers of explosions, etc.).

e. Sedentary occupations (clerks, teachers, office-workers, etc.).

2. Dangers of the occupation.

a. Poisonings (mineral, metallic, gases, vegetable, and animal).

b. Infections (such as anthrax or tuberculosis).

c. Accident rate (mining, heavy industries, manufacture of explosives, construction work, railroading, etc.).

3. Conditions under which work is done.

a. Ventilation (removal of dust, gases and other impurities).

b. Sanitary conditions.

c. Working hours.

d. Proper lighting conditions.

e. Adequate and intelligent consideration of the worker's health.

4. A proper wage scale and its effects upon

a. Adequate food of the right kind.

b. Decent housing with proper heating, ventilation, sanitary conveniences, light, and other factors.

c. Opportunity for daily recreation and yearly vacations.

d. Health care and insurance for the worker and his family, chiropractic, medical and dental.

e. Job security—with freedom from worry as regards sudden termination of the work.

CHAPTER XXIV

The Chiropractor and Public Health

Upon receipt of a state license to practice the chiropractor assumes certain responsibilities in regard to public health. He is expected to conform to the health laws established by the department of health of his particular state, and it is advantageous that he acquaint himself with them at an early date as well as with the requirements of city or county health departments. He should cooperate to the fullest with the legal health authorities of his state and city and it is his duty to ascertain just what these requirements are.

It is his legal obligation to see that all births and deaths are duly reported to the proper authorities. Of course these two activities would not be common in the average practice—only in emergencies. Perhaps his outstanding legal obligation to the state health department is the reporting of suspicious as well as clear cases of those diseases designated as being reportable.

The following is a list of the more common diseases considered reportable by most Public Health Authorities of the United States.

Actinomycosis
Anthrax
Chicken pox (varicella)
Cholera
Conjunctivitis (acute infectious)
Dengue fever
Diphtheria
Dysentery (amebic)
Dysentery (bacillary)
Encephalitis (lethargic)
German measles (rubella)
Gonorrhea
Influenza
Leprosy
Malaria
Measles (rubeola)
Meningococcic Meningitis
Mumps
Paratyphoid fever

Plague (bubonic)
Pneumonia
Poliomyelitis
Psittacosis
Puerperal septicemia
Rabies
Rocky Mountain Spotted fever
Scarlet fever
Streptococcic throat
Small pox
Syphilis
Tetanus
Trachoma
Trichinosis
Tuberculosis (pulmonary)
Tularemia
Typhoid fever
Typhus fever
Undulant fever
Whooping cough
Yellow fever

PLACARD DISEASES

A placard disease is one which requires that a warning sign shall be posted to serve as a warning to the public. The placard shall be posted in a conspicuous place on the house, dwelling or other habitation in which the disease is found. The most common placardable diseases are measles, whooping cough, mumps and chicken pox, plus others designed as placardable by local health authorities.

QUARANTINABLE DISEASES

A quarantinable disease is one which in the discretion of the authorities is best controlled by placing the sick person in quarantine. The more common quarantinable diseases are scarlet fever, diphtheria, cerebro-spinal meningitis, cholera, leprosy. smallpox, infantile paralysis, bubonic plague and epidemic influenza. Others may be added in certain localities.

QUARANTINE

By quarantine is meant the limitation of the personal association and physical surroundings of persons exposed to a communicable disease for a period of time equal to its longest incubation period. It means the complete detention of a person

within his own residence or temporary residence and the exclusion of the public from his living quarters. In a case of small pox, for example, the individual is retained in quarantine for a period equal to the incubation period of about 14-21 days, but if other members of the family stay away from the infected individual they may leave the place of quarantine to pursue their occupations.

ISOLATION

Isolation is the separation and detention of persons presumably or actually suffering from a communicable disease, or who are known carriers of a communicable disease, in order to prevent the conveyance of the infectious agent to unexposed, susceptible individuals. Isolation is usually carried out in a building separated from others, or in a detached ward of a hospital, and is done under the supervision of trained personnel who will see to it that strict personal hygiene is practiced and enforced. Certain of the quarantinable diseases may call for isolation when they are in a particularly virulent or persistent form.

NUISANCES

Nuisances constitute an important part of public health and their control and abatement rightfully belong to the health officer although the chiropractor may contribute to the health and welfare of his community when he is cognizant of a public nuisance and reports same.

A nuisance is anything that is injurious to the health, indecent, or offensive to the senses. It may also be an obstruction to the free use of property so as to interfere with the comfortable enjoyment of life and property. From the standpoint of public health the most common nuisances are: (1) improper sewage disposal, (2) pollution of municipal or private water supply, (3) improper control of mosquito breeding grounds such as swamps,

ditches, etc., (4) unwholesome odors (5) diverting a river or stream from its natural course to the injury of others.

Individuals suffering from a nuisance may have redress through proper legal channels such as civil actions, action for damages, injunction, or abatement through statutory powers.

INCUBATION AND QUARANTINE CHART OF COMMON DISEASES

DISEASE	INCUBATION PERIOD	QUARANTINE PERIOD
Cerebro-spinal meningitis	About 7 days	Until 2 weeks after temperature has returned to normal. Should have three negative cultures from the nasopharynx, each culture being taken at a five-day interval.
Chicken Pox	About 14 to 21 days	Until all crusts have fallen and scars are completely healed—about twelve days after the appearance of the eruption.
Diphtheria	From 2 to 5 days.	About three weeks. Two successive negative cultures should be obtained from nose and throat, taken at least 24 hours apart and the first not until 9 days after the appearance of the disease.
Measles	About 14 days.	Until at least five days after the appearance of the rash, and temperature is normal for 48 hours.

DISEASE	INCUBATION PERIOD	QUARANTINE PERIOD
Mumps	About 14 days but may vary from 4 to 21 days.	One week after disappearance of swelling or a minimum period of ten days after onset of disease.
Poliomyelitis	From 3 to 10 days.	A minimum of three weeks after onset.
Scarlet Fever	From 2 to 7 days with 3 days being the average.	About three to four weeks in the average case, and until all discharges from nose, throat, etc., have ceased—usually by the third week.
Small Pox	From 12 to 14 days.	About three weeks; less if all scars completely healed.
Whooping Cough	About 14 days.	About three weeks. Usually one week after the disappearance of the last characteristic cough is satisfactory.

Tush average out at 3 weeks
(Febrile Disorder 10 day average

CHAPTER XXV

Demography

DEMOGRAPHY is defined as being the study of mankind collectively and it deals with such vital statistics as births, marriages, deaths and disease. This study is ordinarily confined to such features of environment and public health measures as may vitally affect the general population of a community or a nation.

One method of determining certain important figures is that used by the federal government which conducts a census every ten years to gain data as to the number of inhabitants of particular areas as well as the age, sex, occupation, birthplace and race.

From the standpoint of public health however, other statistics such as death rates and birth rates are more important and such figures are used extensively in demographical surveys. The main value to the public health officer of such statistics lies in the use to which he may put them. If an increasing number of cases of a certain disease are being reported in a community, such figures may give warning of an impending epidemic and steps may be taken to combat it. Such statistics also show how healthy a community or a nation may be. It tells when the race is in danger of becoming extinct due to a death rate higher than a birth rate or it may predict an increase in a population when a rising birth rate overshadows the death rate.

BIRTH RATE. The recording of all births is now common practice throughout the United States. Births should be recorded with the registrar of births who forwards such information to the state office. Various forms of birth rates are used by public authorities to study disease and population trends.

a. *CRUDE BIRTH RATE*—is the relation of the number of births during a year to the population of that year. It

is usually based on the rate per 1,000 of the population of an entire country. The crude birth rate for the United States in 1934 was about 17.1, meaning that for every thousand persons in the United States in 1934 there were 17.1 births registered. The highest crude birth rate was that of Russia with 42.7 and Sweden was lowest with 13.8 in 1935.

b. *TRUE BIRTH RATE*—is the relation of the number of births to the female population of child-bearing age: i.e., fifteen to forty-five years. For example, in Australia in the year 1922, there were 19.65 babies born to every one hundred married women in the age group of fifteen to forty-five. On this basis the true birth rate which is now figured on the rate of births per 1,000 women of child-bearing age would be 196.5. A true birth rate might include the legitimate rate per 1,000 women of child-bearing age, and the illegitimate birth rate per 1,000 women of child-bearing age.

From the standpoint of the individual, the recording of births may be of future value in enabling him to satisfactorily establish proof of age, parentage and citizenship.

DEATH RATE—is the ratio of the total number of deaths in a community to the total population, usually figured on the basis of the number of deaths per 1,000, 10,000 or 100,000 of population over a period of one year. The figures obtained by such computation are referred to as the crude death rate and of course the degree of accuracy is dependent upon an accurate census and death records. For example, if a community of 200,000 people has 3,000 deaths annually the death rate is figured as follows: 3,000 divided by $\frac{200,000}{1,000} = 15$ (the death rate). The figure obtained means that for every thousand people in this particular community during the given year there were 15 deaths. On a national basis the average death rate per thou-

sand people in the United States in 1933 was 10.7. In Chile it was 26.8, and in New Zealand it was only 8.0.

In order to obtain more specific figures for comparative purposes the death rate may be computed on the basis of age, sex or occupation. Also, causes of death may be given as a means of comparison and these are based upon the classification table advanced by the International Institute of Statistics. This table gives 85 main causes or groups of causes of death and has now been adopted by most countries for the purpose of making International comparisons.

Death rates are influenced by the age and sex and social features of the population. Hygienic and sanitation measures and the number of people employed in the practice of healing are other factors which may influence the death rate. Occupation is also of importance in determining the death rate because it is higher among members of a hazardous occupation than among a group employed in a non-hazardous occupation. This method of grouping death rates according to the involved factors of age, sex, etc., is called a *specific death rate* or a *specific mortality rate.*

INFANT MORTALITY RATE—is the rate of death per thousand of infants under one year of age. About 9% of all infants born die during the first month of life. The average infant mortality rate for the United States was 48.2 per thousand live births in 1939. This is an overall rate and includes still-births (births in which no sign of life was ever visible from the time of parturition). In the case of computing still-births death rate, or *natimortality* as it is called, the proportion of still births to the general birth rate is used.

The most common causes of death among infants include birth injuries or trauma such as cerebral hemorrhage, and rupture of the liver. Others are the acute gastro-intestinal diseases, and the acute respiratory infections. Because hygienic surroundings seem to play such a very important part in the infant mortality rate this figure is used oftentimes as an index to the gen-

eral sanitary conditions of a given community. For example, the infant mortality rate is higher in poor, crowded, unsanitary urban areas than it is in a region where sun and fresh air and good environmental surroundings are the rule.

MATERNAL MORTALITY RATES. Also called Puerperal Mortality rates and refer to the deaths of women as the result of pregnancy, labor and the lying-in period or puerperium. It is based on the number of such deaths per 1,000 or 10,000 births. In the United States this rate has been rather consistently maintained at approximately 6 per thousand births each year. In 1927 it was 6.7 per thousand. Every year throughout the United States as a whole about 17,000 women die of child-birth and its associated causes, which figures make an unenviable record as compared with many European countries, such as Finland with 3.0 per thousand, and England with 4.1 per thousand.

There are certain factors which influence this maternal death rate. One of them is race. Almost twice as many colored women die at child-birth as do white women. Poverty is another factor which has many phases such as food, housing, lack of pre-natal care, poor medical and nursing care, and oftentimes industrial employment prolonged up to the time of confinement.

The most common causes of maternal mortality are ectopic pregnancy, abortion, hemorrhage, septicemia and eclampsia.

CASE RATE is also called the morbidity rate and is the proportion of cases of a given disease occurring during the year per 1,000, 10,000 or 100,000 of population. This sickness rate is based upon the specific disease in question. For example: if 20 cases of measles per thousand people in a given community is reported for a given year the case rate would be 20. This figure enables the health officers to make specific comparisons with previous case rates and to detect a tendency towards an epidemic, when, say, the case or morbidity rate for measles show 40 cases of measles per thousand people.

CASE FATALITY RATE is the number or percentage of cases of sickness which terminate fatally. In 1930 the case fatality rate among cases of circulatory disorders was 239 per 100.000 deaths.

FATALITY RATE is also known as the *lethality rate* and is the number of deaths per 100 cases of a specific disease. For example, if in a given community there were 100 notified cases of diphtheria and 12 of these cases died the fatality rate would be 12. Increases concerning the fatality rate in a given disease may mean several different things: (1) a particularly virulent form of the disease, (2) cases are not responding to treatment satisfactorily, (3) practitioners are not reporting all the cases of the disease.

On the other hand, if the mortality rate for a particular disease is very low it may signify, (1) a comparatively mild form of the disease, (2) the cases are responding to treatment satisfactorily, (3) incomplete death records as to the true cause of death, and (4) highly efficient reporting of the total number of cases of the particular disease.

EPIDEMIOLOGICAL SURVEY is the classification and tabulation of data received from various health sources in a community, state, or nation. It is usually based upon the prevalence of a certain disease in a certain locality at a given time. This survey may prove of value in several different ways, such as (1) it gives a history of a specific disease over a period of years, (2) it gives the degree of success in combating this disease, (3) it indicates the necessary hygienic and sanitation measures to prevent and control the disease, (4) it shows the geographical prevalence of a particular disease, i.e., malaria in the South is not uncommon, but it is rare in the Northern states.

CHAPTER XXVI

Death

Death is the cessation of all vital activities or the cessation of life. It may consist of two distinct types: somatic and cellular.

Somatic death is that of the entire organism and is death as it is commonly understood; i.e., the permanent termination of all the various processes associated with life.

Cellular death is that of cell life. It is due to a depleted nerve supply to the tissue cells proper, and is the type of morbidity present in the necrotic changes of pathology. Due to the natural processes of life, tissue cells are constantly being destroyed and replaced by new cellular structures from conception until death. There may be large amounts of cellular death present in a body without producing somatic death although it may hasten the advent of the latter. It is also scientifically true that death in the entire body does not occur simultaneously because the nervous tissue and other cells may respond to the application of certain stimuli for some time after somatic death is evident. Chiropractically this would not be considered true life because life is controlled function, and these reactions are evidently only responses to stimuli of either a chemical or mechanical nature.

The *vital organs* are those which must be retained in function or else somatic death will follow their removal or cellular destruction. The three vital systems of life are, nervous, respiratory, and circulatory. Death is instantaneous after removal or disintegration of the central nervous system. Seven minutes is all the time needed to kill the body if the circulatory or respiratory systems are destroyed. If both kidneys, the liver, or the pancreas are removed, death follows in a few days, and yet a gall-bladder, stomach, spleen, or appendix may be removed with no untoward effects.

SIGNS OF DEATH

Occasionally circumstances arise which make it difficult to determine with surety that life is no longer existent in the body. Because of this, special signs may be looked for to make sure that somatic death is present. These include obvious signs and some not so obvious except under special tests.

1. Cessation of the heart beat.
2. Absence of respiratory murmur.
3. Ashy color; absence of normal pink color when a strong light is placed beneath the closed fingers.
4. Failure of a mirror to show a fog when held in front of the mouth and nose.
5. Absence of chest movement; observed by placing a glass of water on the chest.
6. Absence of skin and pupillary reactions.
7. If a blister on the skin caused by the application of a flame doesn't fill with fluid but instead fills with air and bursts with a crackling noise, death is present.
8. An artery may be cut, and if the heart is still active, there will be a gushing of blood.
9. Instilling a drop of ether in the eye will not produce a reaction if death is present; but if still alive, the eye will redden.
10. Absence of electric reactions in the muscles.
11. Facies Hippocratica or the "mask of Death"; characteristics of which are pale, thin lips, thin nose, sunken eyes, and ashy, pale skin.

DETERMINATION OF LENGTH OF TIME BODY HAS BEEN DEAD

The leg is divided from the knee to ankle into three equal parts, the patella being considered as a fourth part; the thigh is divided into six equal parts, thus giving ten areas from the groin

to the ankle. If section one at the ankle is colder than section two above the ankle, the body is assumed to have been dead for one hour; if section two is colder than section three directly under the patella, the body is said to have been dead for two hours, and so on.

CADAVERIC CHANGES FOLLOWING SOMATIC DEATH

1. *Rigor mortis* is the stiffening of the body after death and may occur within two to twenty hours after death and last for as long as nine days. It first involves the muscles of the eyelids and jaws and neck, and then spreads to other parts of the body. It is due to accumulated lactic acid causing precipitation of muscle protein with a resultant rigidity of the muscles.
2. *Livores mortis* or "death spots" are dark red discolorations appearing on the body within one to eight hours after death and are due to diffusion of settled capillary blood into the tissues.
3. *Cooling of the body* begins rapidly after death and then slows down so that about twenty-four hours is needed to cool the body to the temperature of the surrounding air.
4. *Putrefaction* is due to the action of certain bacteria contained within the body cavities. The brain succumbs first with the uterus being the last organ to putrefy.

POSTMORTEM EXAMINATIONS

A post-mortem examination, or autopsy, is done on certain cases when the diagnosis of the fatal dis-ease was not certain. Further arguments advanced for the examination of the body after death are that these procedures are important for advancement of science in its fight against death; they help in the discovery of rare or new diseases, and assist in the study of hereditary conditions.

The major arguments presented against it, by the layman particularly, are that the body is subjected to gross mutilation and that an autopsy makes embalming difficult. However, pathologists claim that these statements are fallacious if the work is carried out properly. Written consent of the family or of the deceased in his will must be obtained; otherwise, an unauthorized post mortem may be a basis for civil or criminal action.

A full report of the findings on the case must be written up under the direction of the pathologist in charge, and several copies are made, one for the laboratory, one for the pathologist, and one for the patient's records.

Glossary

Acidosis—a condition characterized by a decrease in the alkalinity of the blood. Also called Ketosis.

Acquired Immunity—an immunity acquired after birth, usually either by active or passive means. See chapter on Immunity.

Active carrier—a person who has become a carrier of a disease after recovering from it.

Active immunity—the immunity brought about by an attack of a specific disease. See chapter on Immunity.

Aerobe—an organism which requires the presence of oxygen to carry on its activities.

Agglutinin—a specific antibody which has the power to agglutinate or clump the bacteria which cause it to be developed by the body.

Allergen—a substance capable of bringing about an allergic reaction when introduced into the human body. It is usually a foreign protein.

Allergic—a state of being susceptible to an allergen. See chapter on Hypersensitiveness.

Allergy—a state of hypersensitivity to certain substances or allergens.

Amboceptor—a substance in blood serving as one of the active elements in cytolysis, the other element being complement.

Ameba—a single-celled organism. Some amebae are pathogenic to man.

Amebiasis—state of being infected with pathogenic amebae as in amebic dysentery.

Anabolism—the building-up process in metabolism; the conversion by living cells of simple substances into complex compounds.

Anaerobe—an organism which grows best in the absence of oxygen.

Anaphylaxis—an excessive susceptibility to any special substance such as protein, resulting from a previous introduction of the same substance into the body. See Immunity.

Angstrom Unit—an internationally adopted unit of wave length —1/254,000,000".

Animate—having life.

Anopheles—the mosquito whose bite is said to transmit malaria to man.

Anoxemia—deficiency of oxygen in the blood, such as occurs at high altitude.

Anthelmintic—a drug given to expel worms.

Antibacterial serum—a serum which destroys or inhibits bacteria.

Antibody—a substance developed in the body which reacts against bacteria and other foreign substances and gives immunity.

Antigen—a substance which, upon entering the body, stimulates the production of antibodies. Most antigens are bacteria.

Antiseptic—a substance which checks the growth of bacteria, but does not necessarily kill them. See Disinfection.

Antisepsis—the absence or exclusion of putrefactive organisms.

Antithrombin—a substance in the blood which prevents or retards coagulation.

Antitoxin—a serum derived from the blood of an immunized animal or human which contains substances capable of destroying or neutralizing bacterial toxins.

Antitropin—a general term for an antibody.

Anypnia—a condition of insomnia or sleeplessness.

Aphrodisiacs—agents which stimulate the sexual desire—alcohol, theelin, and Spanish fly are examples.

Appetite—the desire for food, but it is not necessarily hunger.

Argyria—poisoning from exposure to silver.

Ascariasis—symptoms produced by certain round and thread worms found in the bowel.

Aschheim-Zondek Test—used to detect pregnancy. See Test.

Asepsis—a condition free from germs or infection.

Asphyxia—unconsciousness due to lack of internal or cellular respiration; drowning, choking, etc.

Assimilation—changing of food into living substance by an organism.

Attenuated—the condition of a microorganism when rendered less virulent by successive cultures.

Audiometer—an instrument used to test hearing.

Autoclave—an apparatus used to sterilize substances by steam under pressure.

Autogenous vaccine—a vaccine prepared from a bacterial culture obtained from the patient himself, who then receives an inoculation from the culture.

Autoinfection—an infection of one part of the body, the source of which was another part of the body; example, tuberculosis of the lungs later invading the spine.

Autopsy—examination of the internal organs after death to determine the nature of the pathology or the cause of death.

Avitaminosis—any disease due to lack of vitamins in the diet. Also called a deficiency disease.

Azoospermia—the absence or weakness of sperms in the male—a cause of sterility.

Bacillus—a rod-shaped bacterium.

Bacteria—unicellular, microscopic, vegetable organisms which cause putrefaction or fermentation.

Bacteremia—a condition in which bacteria are present in the blood stream.

Bactericide—any substance, or procedure, which destroys bacteria.

Bacteriolysin—a specific antibody capable of dissolving the bacteria which caused it to be developed by the body; said to be derived from the white blood cells.

Bacteriophage—a substance developed in certain bacterial cultures which destroy the bacteria by autolysis. Used in colon-bacillus infections, cholera, and dysentery.

Baker's dermatitis—a skin infection caused by yeasts.

Barber's itch—an infection of the hair-follicles of the face with Trichophyton tonsurans. See Parasites.

Basal Metabolism—a measurement of energy production: the minimal heat (cell-energy) produced by an individual when resting, 18 hours after eating, with body temperature normal.

Bedbugs—(Cimex leticularis); upon biting they inject an irritating substance which causes wheals to appear. Usually, poor hygiene permits their presence.

Bends—(caisson disease) due to increased atmospheric pressure which increases the absorption of nitrogen into the blood stream. See Air.

Benign—a term applied to tumors which are non-malignant or non-cancerous.

Beriberi—an endemic and infective form of polyneuritis due to lack of vitamin B. Essentially an Oriental disease due to a diet of polished rice.

Biological—anything relating to biology, or the study of life.

Biological transfer of infection—transmission of an infection to a human by an animal or insect in which part of the life cycle of the pathogen takes place in the animal or insect; viz., malarial organism and the mosquito.

Birth control—any system or device used to prevent conception.

Blackwater fever—a fatal form of malaria accompanied by hemoglobinuria.

Blastomycosis—an infection caused by certain budding fungi. Pulmonary Blastomycosis resembles tuberculosis.

Blindness (Night)—normal vision in daylight but subnormal at night due to a Vitamin A deficiency.

Blindness (Snow)—temporary blindness resulting from glare of sun or snow.

Blood serum—the fluid which escapes after blood has clotted or is centrifuged.

Bloody flux—a common name for dysentery.

Bot flies—lay eggs under skin of the host and furuncular swellings appear.

Botulism—a condition of poisoning by ingestion of the toxin liberated by the Bacillus botulinum.

Breakbone fever—synonym for Dengue fever.

Brownian movement—the peculiar dancing motion of minute particles suspended in a fluid, observable microscopically.

Bubo—a suppurated lymph gland; most commonly found in the groin or axilla, and associated with syphilis or gonorrhea.

Bubonic plague—an infectious fatal disease associated with the Bacillus pestis.

Burton's line—the bluish line found along the gum line of people suffering from lead poisoning.

Cachexia—a wasting away due to prolonged disease, such as cancer.

Cadaver—a corpse.

Caisson disease—Diver's palsy. See "the bends."

Calorie—the amount of heat necessary to raise the temperature of one gram of water from 15 degrees Centigrade to 16 degrees Centigrade. However, in estimating the calories in food, a large calorie is used which is 1,000 times this amount. It is written capitalized—Calorie.

Carbohydrates—a class of compounds composed of carbon, hydrogen, and oxygen. The hydrogen and oxygen are in the proper proportion to form water (H_2O).

Carbon tetrachloride—a common source of industrial poisoning. It is used in the cleaning of type, in fire extinguishers, as a stain remover, and as a delousing agent. Toxic effects come from inhalation.

Carotin—the coloring matter of carrots and the source of Vitamin A to the body.

Carrier—a person who carries disease germs. Usually the individual is not ill of the disease.

Catabolism—destructive side of metabolism; the breaking-down by living cells of complex materials into simpler substances, most of which are excreted.

Cell—the protoplasmic body which forms the unit of all life—animal or vegetable.

Cellulose—the supporting framework of plants. It is a carbohydrate, but is not absorbed during digestion.

Centigrade—a scale of heat measurement divided into 100 degrees between the freezing and boiling points.

Chancre—the initial lesion of syphilis. Forms a bright red ulcer without pain.

Chancroid—a non-syphilitic venereal ulcer which is highly infectious.

Charley horse—an injury to the muscles, usually a bruise or tear, associated with athletics or heavy industry.

Chemotaxis—the reaction to a chemical, whereby cells may be attracted (positive chemotaxis), or repelled (negative chemotaxis) by the chemical.

Chiggers—a tick which burrows under the skin and sets up a dermatitis. See Insects.

Chillblains—a swelling and itching of the nose, hands, or feet caused by exposure to damp cold.

Chiropractic—a philosophy, science, and art of things natural; a system of adjusting the segments of the spinal column by hand only; for the correction of the cause of dis-ease. (B. J. Palmer.)

Chlorinated lime—calcium hypochlorite; used extensively in the prevention of ringworm and as an antiseptic.

Chlorophyll—the green coloring matter of plants which acts as a catalyst enabling the plant to take carbon-dioxide from the air and combine it with water to form a carbohydrate.

Cholera—1. Asiatic. An acute infectious disease associated with Koch's comma bacillus, or the Vibrio cholera. Has a high fatality rate.

2. Infantile. An acute childhood disease characterized by inflammation of the gastro-intestinal tract, vomiting and collapse. The prognosis is guarded.

3. Morbus. An acute, sporadic disease not associated with the Vibrio cholera but resembling cholera clinically. Prognosis is favorable.

Chromosomes—masses of chromatin which appear in a cell during that process of cell division called mitosis. They transmit the hereditary factors of the cell.

Chromium poisoning—due to exposure in certain industries such as dyeing, staining furniture, and chromium plating.

Cinesia—sickness caused by motion as in a car, plane, or train.

Climatology—the study of climate and its relation to hygiene and health.

Coccus—a spherical shaped bacterium, such as the pneumococcus.

Colony—a growth of bacteria on a culture medium which is visible to the naked eye.

Coma—a state of profound unconsciousness from which it is impossible to arouse the patient; may be the result of disease or trauma.

Commensalism—the association of two organisms in which one is benefited and the other is neither injured or benefited.

Communicable—a disease capable of being spread by direct or indirect contact.

Complement—a substance found in normal blood serum which is capable of destroying bacteria or other cells when brought in contact with them and activated by a proper amboceptor.

Complement fixation—the fixing or destruction of the complement when the proper antibody, antigen, and complement are mixed together. This reaction is the basis of the complement fixation test for syphilis, gonorrhea, and other diseases. See Tests.

Conception—the union of the male sperm and the female ovum.

Congenital—existing at the time of birth, or occurring during fetal life.

Contagion—the communication of a disease by direct or indirect contact, or by fomites.

Contagious—a highly communicable disease, usually transmitted by direct contact.

Contagium—the organism causing infection, or the morbific agent transmitting a disease.

Contamination—infection of a person by contact with the morbific matter, or the soiling of any person or article with infectious matter. A bandage containing pus would be contaminated.

Contraceptive—an instrument of birth control used to prevent conception, such as pessaries, condoms, or medications.

Convalescent carrier—a person recovering from a disease who harbors the disease germs during convalescence.

Convalescent serum—the blood serum of an individual who has recently recovered from a specific disease. Convalescent serum therapy is the inoculation of an individual sick from a disease with the blood serum of an individual recently convalesced from that same disease.

Convection—transmission of heat by liquids or gases in which the heated particles below rise and the colder particles above descend to become heated and then rise.

Conveyor—a carrier of disease.

Corex D—glass—a special glass made by the Corning Glass works which allows more natural ultra-violet rays to pass through than any other glass except quartz.

Corrosive—a substance having the power to corrode, or eat away other substances. Nitric acid, phenol and lysol are typical corrosives.

Crede's Method—a public health procedure required in many states in which a 1% silver nitrate is instilled into the baby's eyes following birth, for the purpose of eradicating any possible gonorrheal inflammation of the eyes.

Culture—a group of micro-organisms grown on a culture medium in the laboratory.

Culture medium—the food material used in the laboratory upon which a bacterial culture is grown. Common media include beef broth, agar, vegetables, and blood.

Cyanide poisoning—an industrial poisoning found in mining, photography, and electro-plating.

Cyesiology—the study of pregnancy—obstetrics.

Cyemology—the study of embryology.

Cytology—the study of cells.

Cyton—a cell.

Cytolysin—a specific antibody which brings about the dissolution of cells.

Cytoplasm—the protoplasm of the cell outside the nucleus.

Dactylogram—a finger-print used for identification purposes.

Dakin's fluid or solution—a solution for cleaning wounds. It is a .4% to .5% solution of sodium hypochlorite.

Death—the cessation of life: Molecular—of individual cells; Somatic—of the whole organism.

Decay—the decomposition of organic matter due to the action of oxygen and certain bacteria.

Decubitus—a bed sore; the result of a prolonged wasting disease, or poor nursing and poor hygiene.

Defensive protein—an antibody. The two are synonymous.

Demulcents—substances which soften the skin, such as olive oil and cocoa butter. Often used as sunburn preventives.

Denatured alcohol—alcohol mixed with benzene, methanol, or other chemicals; unfit for human consumption but may be used industrially.

Dengue—an acute febrile disease comparatively non-fatal.

Deodorant—an agent which removes unpleasant odors; example, quick-lime.

Detergent—a cleansing agent or drug.

Detritus—any degenerated tissue.

Diagnosis—the recognition and naming of a disease. May be physical, clinical, or laboratorical.

Dialysis—the passage of a solute through a suitable membrane.

Diaphoresis—profuse sweating.

Diathermy—the use of a high frequency current to generate heat in a specific part of the body for therapeutic purposes.

Dick Method—the injection of scarlet fever toxin-antitoxin to provide immunity against scarlet fever.

Dick Test—a skin test made to determine the susceptibility of an individual to scarlet fever. See Tests.

Dietetics—the scientific choosing of foods to maintain a state of health, or to deal with disease.

Digestion—the breaking down of food into simpler materials that can be absorbed.

Diplococcus—spherical organisms occurring in pairs, such as the Diplococcus intracellularis meningitidis.

Direct contact—the spreading of a disease by direct or intimate contact between an infected and a non-infected individual.

Disinfectant—a chemical, or agency, which kills all pathogenic organisms.

Disinfecting agents—the chemicals used to bring about disinfection.

Disinfection—the process of using a disinfectant.

Distillation—a form of water purification in which the water is heated to the point of volatization and then is condensed back to its original state.

"Drinker" respirator—the proper name given to an apparatus designed to give artificial respiration over a long period of time.

Droplet infection—the infection supposedly thrown out through the spray of an infected individual when he coughs, sneezes, or talks.

Dyscrasia—a state of disease supposedly due to toxins in the blood.

Echinococcus—a small tape-worm found in the adult form in dogs and wolves.

Eclampsia—a major complication of pregnancy, characterized by convulsions of toxic origin.

Ectogenous—an infection having its origin outside the body.

Ectopic—a term used in obstetrics to denote an abnormal position of the fetus outside the uterine cavity.

Ectoplasm—the outermost layer of protoplasm in the cellular structure of a single celled animal.

Effluvium—an odor or vapor, usually noxious in character.

Ehrlich's Side Chain Theory—a theory of immunity commonly accepted today. Also called the chemical theory of immunity. See Immunity.

Electron—the smallest charge of negative electricity known to exist.

Electrotherapeutics—the use of electricity in the treatment of disease.

Elephantiasis—a lymphatic involvement most common in tropical countries and associated with a parasite. See Parasites.

Encapsulated—surrounded by a capsule.

Endemic—a disease which is more or less continuously present in a community, or among a certain race or people. Malaria may be considered endemic to New Guinea.

Endogenous—an infection having its origin inside the body.

Endoplasm—the layer of protoplasm nearest the nucleus in the cellular structure of the unicellular animal.

Endotoxin—a bacterial poison liberated upon the disintegration of the organism producing it.

Epidemic—a disease not usually found in a community, but which attacks a great number of people at the same time and spreads rapidly.

Epidemiology—the science of epidemics.

Epilating dose—a term used to denote the amount of X-ray or radium radiation which causes a temporary loss of hair.

Epispastics—chemicals which cause a blistering and destruction of the skin, such as sulphuric acid.

Escharotic—any corrosive or caustic chemical, such as acids, alkalies, phenol, etc.

Etiolate—the pale, sickly appearance of a person resulting from lack of exposure to light.

Etiology—the study of the causes of disease.

Eugenics—the study of selective breeding.

Facultative—a term applied primarily to bacteria or parasites which denotes the power to adapt to unusual circumstances. For example, a facultative anaerobe is an organism that lives best in oxygen; but can live without it.

Familial—a term used to describe an abnormality, disease, or tendency towards disease common to a family.

Favus—synonym for honeycomb ringworm or crusted ringworm.

Fecundation—fertilization or impregnation.

Fetation—a state of pregnancy.

Fetid—a rank or foul odor; a nuisance from the standpoint of public health.

Filtrate—the fluid which has passed through a filter.

Filtration—the process of passing a fluid through a filter.

Flash Method—a method of pasteurization in which the milk is heated to 85 degrees Centigrade and then cooled suddenly. See Milk.

Flux—the diarrhea. "Bloody flux" is another name for dysentry.

Focal—an infection occurring near a focus, such as a tonsil. The bacteria develop in a circumscribed area from which they spread via the bloodstream.

Foods—nutritional substances necessary to nourish, maintain, and protect the body.

Foot-candle—a unit of light measurement; the amount given off by a single candle at a distance of one foot.

Formalin—a 40% content of formaldehyde in wood alcohol. Used as an antiseptic.

Fractional sterilization—a method of sterilizing food; the substance is heated to a relatively low temperature for about one hour with the process repeated every day for three or four days. The temperature used is about 80 degrees Centigrade. This method is said to destroy spores which might develop between heatings.

Fumigation—a form of disinfection by gas which destroys bacteria, insects, and vermin.

Fungi—the lowest forms of plant life such as bacteria, molds, yeasts, and mushrooms; a form of thallophyte which does not contain chlorophyll.

Gamete—any cell which undergoes sexual reproduction, such as the human ova and spermatozoa.

Gangrene—a putrefaction of soft tissue arising from impaired blood circulation due to injury, frost-bite, etc.

Genes—certain structures found in chromosomes which are said to impart the characteristics of parents to off-spring. Also called determiners.

Genetics—the study of heredity or the origin of the natural characteristics of the individual.

Germ—any microbe, particularly pathogenic bacteria.

Germicide—any agent which will destroy bacteria or germs.

Gerocomia—the hygiene or care of old people.

Gestation—a state of pregnancy.

Gibbus—a spinal hump, particularly of the dorsal region; often seen in tuberculosis of the spine. Also called a gibbosity.

Glanders—a disease primarily found in horses and mules but supposedly transmissible to man. Associated with the Bacillus mallei.

Gleet—chronic gonorrhea.

Gram negative bacteria—bacteria which lose a Gram stain in favor of a counterstain.

Gram positive bacteria—bacteria which retain the violet Gram stain and reject a counterstain.

Gram's stain—a staining method devised by Gram, a Danish bacteriologist. Most commonly employed of all bacterial staining methods.

Gynecology—the study of the diseases of women.

Gyniatrics—the treatment of the diseases of women.

"H" agglutinins—specific forms of agglutinins which act upon the flagella, or locomotor organs, of certain bacteria. They appear late in the course of a disease. Their action upon the typhoid bacillus is typical.

Habitat—the location in which an organism usually or naturally lives.

Hair-dye—many hair dyes are dangerous to health because they contain silver nitrate or analine dyes which upon entering the eyes, may set up a severe conjunctivitis.

Hay fever—an allergic disease affecting the nose and upper respiratory tract.

Heat exhaustion—severe prostration from exposure to heat. See chapter on heat.

Heat stroke—opposite clinical signs of those of heat exhaustion. See chapter on heat.

Heat therapy—use of heat in treatment of diseases and body ailments. Includes hydrotherapy, diathermy, and hot air.

Heliotherapy—the use of sunlight as a means of treating disease; it includes the use of ultra-violet and infra-red rays—either natural or artificial.

Helminthiasis—intestinal infestation with worms or other multicellular parasites.

Hemagglutinin—a type of antibody which will agglutinate red blood corpuscles.

Hemolysin—an agent or antibody capable of causing hemolysis when acting in the presence of complement. Used in complement fixation tests.

Hemolysis—the dissolving of red blood corpuscles.

Heredity—the transmission of characteristics from parents to offspring.

Hereditary—a term used to describe a disease which may be transmitted through some members of a family from one generation to the next.

Hermaphrodite—an individual possessing both male and female reproductive organs.

Heterologous—a term applied to a disease derived from an animal of another species.

Heterophile—a type of antibody, or antigen, which reacts against other antibodies or antigens other than those for which it is specific.

High calorie diet—a diet designed to increase the heat and energy available to the human body. It is used to build up patients suffering from loss of weight or wasting diseases.

Hookworm disease—also called Uncinariasis. It is due to the presence of hookworms in the intestinal tract. See Parasites.

Host—an animal or plant within, or upon which, a parasite lives.

Humidifier—an apparatus designed to increase the amount of moisture in air.

Hunger—the need for food evinced by certain signs of gastric activity. It is different from appetite, which is the enjoyment of food.

Hydatid—a cyst enclosing the echinococcus.

Hydrophobia—rabies. See chapter on filterable viruses.

Hygiene—the science of health and its preservation.

Hyphomycetes—the pathogenic molds.

Ichthyosis—fish-skin, or alligator-skin disease. It seems to be a congenital condition characterized by scaliness, harshness, and dryness of the skin.

Icterus—jaundice.

Icterus hemolyticus—a jaundiced state resulting from the disintegration of the blood.

Ictus solis—heat stroke.

Idiosyncrasy—unusual susceptibility towards a substance, such as a drug, protein, or bacterial poison.

Idiot—an individual with an ultimate intellectual attainment of a four year old child. An *amaurotic idiot* is one who appears normal at birth but develops the symptoms of idiocy a few months later.

Imbecile—an individual who has a mental age of about five to seven years, thus slightly higher intellecutally than an idiot.

Immune—not susceptible to, or protected from, an infection.

Immune bodies—antibodies. See chapter on Immunity.

Immunity—the state of being immune.

Immunology—the study of immunity and its relation to disease.

Implantation—a term used in obstetrics to designate artificial insemination.

Impregnate—fertilization of an ovum by the sperm, or, to produce pregnancy.

Inanimate—not having life; dead.

Inanition—a state of undernourishment due to lack of proper food or improper digestion.

Incubation—the period between exposure to the causative agent of a disease and the appearance of the first symptoms.

Indigenous—native to a country or a particular region, such as malaria to the tropics.

Indirect contact—the transmission of an infection by inanimate objects such as clothing, pencils, cooking utensils, etc.

Infant—technically, a baby under two years of age.

Infection—the invasion of the animal body by bacteria and their subsequent multiplication and production of dis-ease symptoms.

Infectious—a disease capable of being transmitted from one person to another and associated with a micro-organism.

Infestation—an invasion by animal parasites, such as hookworm or tapeworm.

Infra-red rays—a type of radiation found in the sun's rays, electric arc, and infra-red lamp.

Inoculation—the introduction of a pathogenic bacterium into the body for the purpose of producing a mild form of the disease sufficient to arouse the production of immune bodies.

Intercurrent infection—an infection which attacks a person already ill of another disease—(pneumonia occurring during an attack of influenza.)

Intoxication—a state of poisoning, usually from bacterial toxins.

Iodism—a form of poisoning resulting from prolonged use or exposure to iodine or its compounds.

Irradiation—the application of any rays such as X-rays, radium rays, infra-red rays, or ultra-violet rays to a person or object.

Irritant—a toxic substance which produces irritation when contacting the human body.

Isoagglutinins—specific antibodies found in blood serum which agglutinate blood cells of the same species—(human blood agglutinates human blood, rabbit blood agglutinates rabbit blood, etc.)

Isohemagglutinins—substances normally present in human blood which make some blood types incompatible with others. Clumping of the cells may occur if incorrect types are mixed, the reason why blood types must be matched in transfusions.

Isolation—the separation of an infected individual from other persons.

Japanese river fever—tsutsugamushi fever. See chapter on Rickettsia diseases.

Jaundice (Acute infectious)—also known as Weil's disease or spirochaetal jaundice.

Jaundice (Toxemic)—a condition produced by such poisons as snake venom, arsenic, picric acid, and phosphorus.

Jennerization—the production of immunity by inoculation with attenuated bacterial cultures. Named after Edward Jenner, discoverer of vaccination.

Jigger—also known as chigger; a type of insect producing a dermatitis in the human.

Kahn test—a syphilitic test used as a check or a control on the Wassermann test. See Tests.

Kalium (potassium)—a mineral important to normal growth of bone and blood.

Karyokinesis—same as mitosis; the most common form of cell division.

Karyosome—a body within the nucleus of a cell containing all or most of the chromatin.

Katabolism—the breaking-down process in metabolism. (See Catabolism.)

Keeley cure—a well-known method of treatment for alcoholics and opium addicts by means of gold chloride.

Ketogenic diet—a diet designed to produce a mild form of acidosis for the control of epilepsy.

Kinetosis—car sickness or train sickness.

Klebs-Loeffler bacillus—the bacillus of diptheria.

Koch's laws or Postulates—a series of procedures through which a given organism must pass successfully before it can be considered as the cause of a disease.

Korsakoff's psychosis—the mental disturbances and delirious state seen in polyneuritis and alcoholism.

Kreseptol—a disinfectant made from cresol which is more active than the usual cresol solution.

Kromayer lamp—an ultra-violet lamp which is water cooled and has a mercury-quartz unit.

Labor—the process by which the product of gestation is expelled from the uterus after 280 days. Three stages—dilation, expulsion, and placental.

Lactalbumin—a simple protein found in milk and cheese. It is the film appearing on top of heated milk.

Lactation—the secretion of milk.

Lactoalbumin—a protein found in milk.

Languor—weakness, or lack of energy.

Larva—the immature state of some forms of animal life in which they differ greatly in appearance from the adult.

Leishmaniasis—a disease due to infection with forms of Leishmania. See chapter on protozoan diseases.

Lethal—that which causes death.

Lethargy—a condition of sluggishness or stupor.

Leukemia—a pronounced, permanent increase in the number of white blood cells due to a malfunction of the leukocyte-producing tissues.

Leukocyte—a white blood cell.

Leukocytosis—a temporary increase in the number of leukocytes occurring during pregnancy, and digestion; also as the result of inflammation.

Leukopenia—a reduction in the number of leukocytes with the count being 5,000 or less.

Lichen—a skin disease characterized by papule formation. It is associated with fungi.

Local infection—an infection confined to a specific area.

Lumbrical—shaped like a worm; vermiform.

Lymphocyte—a non-granular white blood cell manufactured in lymphoid tissue.

Lysin—a specific antibody which, when added to the proper complement, will destroy tissue cells and bacteria.

Lysis—the destruction of bacteria or cells by lysin.

Lyster bag—an apparatus used in temporary camps, such as military encampments for the purpose of providing a water supply. The bag is rubber-lined and has faucets.

Lyssophobia—the fear of rabies. See chapter on filterable viruses.

Macrococcus—a large unicellular bacterium.

Macrocyte—a much enlarged red blood cell usually found in anemias.

Macroscopic—visible to the unaided eye, such as gross or macroscopic anatomy.

Malaria—a disease associated with certain protozoa. See chapter on protozoa.

Malignant—a term used to designate virulent or fatal growths or tumors, particularly cancer.

Marasmus—a wasting or emaciating condition found particularly in infants, characterized by muscular atrophy. It may follow certain febrile diseases.

Marea—sea sickness.

Materia medica—that branch of medicine which deals with drugs, serum, organic extracts, and bacterial products; their sources, actions, and uses.

Mechanical transfer—the transmission of disease by insects or animals in which the infectious material is transferred mechanically without the causative organism undergoing a cyclic change in the body of the carrier (i. e., the foot of the fly carrying typhoid fever bacilli.)

Mechanotherapy—the use of various mechanical devices to excercise parts of the body passively (an electric horse is a mechanotherapeutic apparatus.)

Metabolism—the physical and chemical reactions within a cell that build-up and break-down protoplasm.

Metachromatic granules—granules found in the cells of certain bacteria which strain more deeply than the rest of the cell.

Metastasis—the spread of disease from the primary site to another part of the body some distance removed (i. e., spread of cancer from the cervix to the breast.)

Microbe—a microscopic, unicellular plant or animal.

Microbiology—the study of microscopic life, either plant or animal.

Micron—one twenty-five thousandth of an inch, used as a unit of measurement of bacteria.

Minimum lethal dose (M.L.D.)—the least amount of toxin which will cause death. It is used to standardize units of antitoxin or toxin. Specifically, it is the smallest amount of a given bacterial poison which will kill a weighed guinea pig within a given period of time.

Mitosis—indirect cell division; it is the most common means of reproduction.

Mixed infection—an infection containing two or more different kinds of organisms.

Molds—a form of microorganism belonging to the fungi group.

Moron—a person having a mental age between eight and twelve years. See idiot and imbecile.

Morphology—the science of form and structure, such as the morphology of bacteria.

Mycology—the study of fungi.

Mycosis—Any disease associated with fungi.

Myopia—Near-sightedness. See chapter on Lighting.

Naprapathy—A school of healing practicing certain methods of manipulation based upon the premise that disease is caused by ligament and connective tissue malfunctions.

Natural Immunity—The immunity with which a person is born.

Natal—Referring to birth.

Necrobiosis—The death of individual cells.

Necrology—The study of statistics concerning death.

Necrosis—The death of a group or collection of cells or a tissue.

Negri Bodies—Certain pathological forms found in the brain tissue of animals suffering from rabies.

Nematode—A thread-like worm. Infestation with nematodes is called Nemathelminthiasis.

Neoplasm—A tumorous growth.

Nonpathogenic—Not capable of causing disease.

Nosography—The science dealing with the classification of diseases.

Notochord—A term used in embryology to designate the cellular rod about which the vertebral column develops.

Nucleus—A spherical body in the cell which carries on most of its vital processes.

Nyctalopia—Night blindness. May be due to deficiency of Vitamin A. The vision is good on bright days.

"O" Aggultinins—A specific agglutinin present in actively immunized cases of typhoid. The agglutinin works on the body of the bacillus typhosus and appears early in the disease. See "H" Agglutinin.

Obesity—The accumulation of an abnormal amount of fat on the body.

Obstetrics—The care of the pregnant woman in the pre-natal, natal, and puerperal periods.

Old Tuberculin—Also called Koch's Old Tuberculin, and abbreviated O.T. A special form of tuberculin.

Optimum—Conditions or circumstances most favorable to the functions of the plant or animal.

Opsonins—Substances present in blood which make phagocytosis possible by rendering the organisms more susceptible to the action of white cells.

Organism—Any living plant or animal.

Osmosis—The diffusion of dissolved substances through a semi-permeable membrane.

Ovum—The female sexual germ, or egg.

Ozone—A form of oxygen in which three atoms of the element are joined to form a molecule designated as O_3.

Pachydermia—A form of elephantiasis also known as Barbadoes leg, or Arab leg. Characterized by lymphangitis, and hypertrophy of the skin and underlying tissues. It usually affects the legs and genitalia.

Panama fever—A form of malaria found in Panama. Also called Chagre's Fever.

Pandemic—A very wide-spread epidemic affecting a large area at a given time, such as occurs when influenza epidemics are active in the entire United States.

Paraphenylendiamine poisoning—A dermatitis caused by using a hair dye, containing paraphenylendiamine hydrochloride which dyes the hair black.

Parasite—Any organism that lives on or within and at the expense of another organism.

Paratrophic—Requiring a complex protein or living matter for food. Sometimes used synonymously with parasitism.

Passive carrier—A person who carries the causative agent of a disease without having been attacked.

Passive immunity—The production of an immunity to a particular disease by injecting the immune bodies directly into the body. The individual plays no part in the creation of the antibodies. See chapter on Immunity.

Pasteurization—The heating of milk to a point below boiling and then cooling it suddenly. See chapter on Milk.

Pathogenic—Capable of causing disease.

Pathogen—Any organism capable of causing disease.

Pediculosis—Lousiness; infected with lice.

Pellagra—A deficiency disease which affects the gastrointestinal and nervous systems. Lack of Vitamin B_2 or G may precipitate pellagra.

Permanent carrier—A carrier of disease who may harbor a pathogenic organism for months or years.

Phagocyte—White blood cells capable of engulfing and devouring bacteria.

Phagocytosis—The act of devouring bacteria by white blood cells.

Phenol coefficient—a method of determining the powers of disinfection of a given chemical by comparison with phenol (carbolic acid). See chapter on Disinfection.

Phylogeny—The ancestral stages in the evolution of the race.

Plasma—The fluid portion of blood when circulating in the body in clotted blood the fluid portion is called serum.

Pleomorphic—Having several distinct forms, as certain bacteria (i. e.,) diphtheria bacillus is pleomorphic—exists in several forms.)

Polar bodies—Deeply-staining structures found in the ends of certain bacterial cells. Diphtheria Bacilli show polar bodies.

Portal—The place of entrance of bacteria, particularly pathogenic bacteria.

Precipitins—Specific antibodies which precipitate the bacteria which caused them to be developed. See chapter on Immunity.

Predisposition—A special tendency toward some particular disease. Also called diathesis.

Primary infection—The first of two infections, one of which occurs during the course of the other, such as influenza turning into pneumonia.

Primipara—A woman who has had her first child or is giving birth to her first child.

Prognosis—A forecast as to the probable outcome of a disease.

Prophylaxis—The prevention of disease.

Protoplasm—The physical basis of all living matter.

Protozoa—Minute unicellular organisms forming the lowest forms of animal life. See chapter on Protozoan diseases.

Psilosis—A tropical disease affecting the pancreas. Commonly called the Sprue.

Psittacosis—Commonly called "parrot fever." See chapter on Animal-borne diseases.

Ptomaines—Nitrogenous basic substances resembling alkaloids formed as the result of bacterial decomposition of dead organic matter.

Puerperal—The post-partum or lying-in period following child birth. The first six weeks following delivery.

Pure culture—A laboratory culture containing only a single species of bacteria.

Putrefaction—The decomposition of animal protein, accompanied by the formation of poisonous and malodorous compounds such as hydrogen sulphide, ptomaines, and ammonia.

Pyretic therapy (fever therapy)—a process of artificially inducing fever either by drugs or the production of malaria. It has been used in the treatment of syphilis and other diseases.

Pyogenic—Capable of forming pus; such bacteria as staphylococci are pyogenic.

"Quantum Theory"—Employed in Epidemiology. It states that all epidemics are due to loss of equilibrium between infection and immunity.

Quarantine—A state of segregation and control over the entry and exit from a place where a communicable disease exists.

Quiescent—Inactive; such as a quiescent disease.

Rabies—Hydrophobia. See Filterable Viruses.

Racial Immunity—That immunity which is peculiar to a race. See Immunity.

Rachitic—Pertaining to rickets.

Radiation—A method of treating certain disease by using x-ray or radium.

Radiothermy—The induction of artificial fever by special short-wave radio apparatus. Similar to pyretic therapy in principle.

Recurrent—A return of the disease after a period of abatement; also called relapse or recrudescence.

Refraction—The deflection of light rays.

Regimen—A hygienic application of general health principles; rest, food, bathing, etc.

Residue-free diet—A bland diet which contains no cellulose or roughage.

Respirator—An apparatus for continued artificial respiration, such as Drinker's respirator. Also an apparatus to purify air breathed through it.

Resistance—The ability or power of the body to ward off disease.

Rigor Mortis—The stiffness seen in corpses. See Death.

Ringworm—A disease of the skin associated with a fungus. See Parasites.

Rubefacients—Chemicals which produce a local reddening and congestion of the skin with an increase of the blood supply to the part. Mustard, turpentine, and certain liniments are rubefacients.

Saccharomyces—A form of yeast not considered pathogenic. Most of them ferment sugars.

Sanative—Having curative or health-giving powers.

Sanitation—The science dealing with the establishment of conditions most conducive to health.

Sapremia—A state of disease due to absorption into the blood stream of poisons liberated by the action of saprophytic bacteria upon dead organic matter. It is sometimes called blood

poisoning. An outstanding example is the puerperal poisoning resulting from bacterial decomposition of a retained placenta.

Saprophyte—An organism that thrives on dead organic matter.

Saturnism—Lead poisoning. See industrial hygiene.

Scabies—Also called the itch; associated with a parasite, the Sarcoptes scabei.

Schick Test—used to detect susceptibility to diphtheria; 1/50 of an M.L.D. is injected under the skin. The appearance of a red spot within 48 hours indicates susceptibility.

Secondary infection—A new infection occurring in an individual already infected.

Secondary sexual characteristic—The characteristics other than the sex glands in which males and females differ.

Sensitization—The process whereby an individual or animal becomes sensitive to a particular substance. See Anaphylaxis.

Septic—A condition caused by the presence of pathogenic bacteria or their toxins; particularly putrefactive bacteria.

Septicemia—A morbid state due to the presence of pathogenic bacteria and their toxins in the blood stream.

Sepsis—Poisoning due to the presence of products resulting from putrefaction.

Serum—An antitoxin which is active against the specific organism from which it was developed.

Serum sickness—A group of symptoms arising in some individuals following the injection of a serum. See Anaphylaxis.

Shock—A body condition characterized by great reduction in the life processes.

Silicosis—A condition caused by prolonged exposure to stone dust. See Industrial Hygiene.

Siriasis—Sunstroke. See Effect of Heat on the Body.

Skin Test Dose—The amount of scarlet fever toxin which will produce a positive reaction in a susceptible individual when injected intradermally. The appearance of a red spot is a positive reaction.

Species immunity—A type of immunity peculiar to a species. See Immunity.

Spontaneous Generation—A theory that organisms arise directly from inorganic substances. Now discarded.

Sporadic disease—one that occurs more or less infrequently, and may affect only a single or few persons. Leprosy may be considered sporadic in the United States.

Spore—A form assumed by certain bacteria when the vegetative forms are subjected to adverse environmental circumstances. The tetanus bacillus forms spores very readily.

Sterile—Absolutely free of all micro-organisms and their products.

Sterilization—The destruction of all life in or on an object. See Sterilization.

Suggestive Therapeutics—The treatment of certain diseases by either suggestion or hypnosis.

Symbiosis—Living together of two organisms, usually obligatory and of mutual benefit.

Tapeworm—Taenia. See Parasites.

Telegony—A theory that the male sperms of a woman's first sex-partner will so change her blood composition that offspring resulting from future intercourse with another partner will continue to bear the characteristics of the first.

Temperature—The degree of sensible heat or cold. See Heating.

Terminal disinfection—Disinfection of a room and its contents after the room has been vacated by a patient. See Disinfection.

Terminal infection—An infection appearing in the last stages of a disease and usually causing death.

Tetanus—Lockjaw.

Therapeutics—The treatment of disease.

Thermal death point—The degree of heat necessary to kill a species of bacteria in a liquid culture within ten minutes.

Tinea—Ringworm. See Parasites.

Toxemia—The presence of toxins or pathogenic organisms in the blood.

Toxin—A poisonous substance resulting from bacterial growth. A toxin also may be of animal or vegetable origin.

Toxin-Antitoxin—A mixture of toxin and antitoxin prepared in the laboratory and usually given hypodermically for the purpose of producing an active immunity. The toxin is slightly more powerful than the antitoxin.

Toxoid—A toxin to which has been added some substance to destroy its toxicity but not to interfere with its antibody-forming possibilities. Formaldehyde is a common substance added to toxin to make toxoid.

Trichinosis—Also known as Trichiniasis. See Parasites.

Trophozoite—The active, vegetating stage in the life cycle of a protozoan.

Tuberculin—A culture of tubercle bacilli and its toxic extract used to diagnose tuberculosis or to determine the state of active immunity against it. See tests for disease.

Typhus—Also called jail fever, or ship fever. See Animal-borne diseases.

Ulatropia—A shrinking of the gums sometimes associated with lead poisoning. See Industrial Hygiene.

Ultramicroscopic—Any object too small to be seen by the ordinary microscope, such as the viruses. See virus diseases.

Ultraviolet—Beyond the violet range of the spectrum. See Lighting.

Uncinariasis—Infestation with hookworms; hookworm disease. See parasites.

Unicellular—Composed of but a single cell.

Unit (Immunizing)—The amount of antitoxin required to neutralize 100 toxin units.

Unit (light)—The foot-candle, or the amount of light given off from a single candle at a distance of one foot. See lighting.

Uviol—A special form of glass highly transparent to ultraviolet light, and used in ultraviolet lamps. See lighting.

Vaccina—Also called cowpox. In man it is recognized as smallpox and may be the result of vaccination.

Vaccination—The process of inoculating an animal or human with a vaccine for the purpose of producing an immunity. See Immunity.

Vaccine—A preparation of a microorganism or its toxins calculated to bring about antibody formation without producing disease.

Vagabond's disease—A condition of pigmentation or skin eruptions caused by lice. The result of poor hygiene. Also called *parasitic melanoderma.*

Vegetative bacteria—Bacteria which do not form spores; or spore-forming bacteria in their non-sporing state.

Ventilation—The circulation of air. See Air.

Virus—A pathogenic micro-organism which is ultramicroscopic and filtrable. See Virus Diseases.

Vitaglass—A special form of glass which readily transmits the ultraviolet rays of sunlight; used in windows for the treatment of rickets.

Vitamins—Foodstuffs of unknown composition needed for metabolism, the absence of which may lead to certain deficiency diseases. See Foods.

Vivisection—Dissection of living animals performed for physiological and pathological research.

Vocational rehabilitation—The training of disabled individuals for new occupations.

War Fever—Another name for Typhus fever.

Wassermann-fast—A condition in which the patient gives a positive Wassermann reaction despite antisyphilitic treatment.

Wassermann reaction—A serum test used in the diagnosis of syphilis. See Tests.

Weil's disease—An epidemic form of jaundice. See Rickettsia diseases.

Weil-Felix reaction—An agglutination test for typhus fever. See Tests.

Widal Test—An agglutination test for typhoid fever. See Tests.

Wuchereria bancrofti—The organism associated with elephantiasis. Also called Filaria bancrofti: See Parasites.

Yava skin—The rough, thickened skin found in elephantiasis.

Yaws—Also known as Frambesia.—A tropical disease in which large masses, pustules, and ulcers form on the skin. Associated with a protozoon, the Treponema pertenue, which closely resembles the Treponema pallidum of syphilis.

Yeast—A form of micro-organism included in the fungus family. It may be pathogenic to man and produce blastomycosis.

Yellow fever—A disease spread by mosquitoes, and characterized principally by jaundice. See Animal born diseases.

Zoology—The science which deals with animal life.

Zoonosis—Any disease acquired from an animal, such as rabies or tuberculosis.

Zymology—The science of fermentation.

Zymotic disease—Any disease resulting from the process of bacterial fermentation.